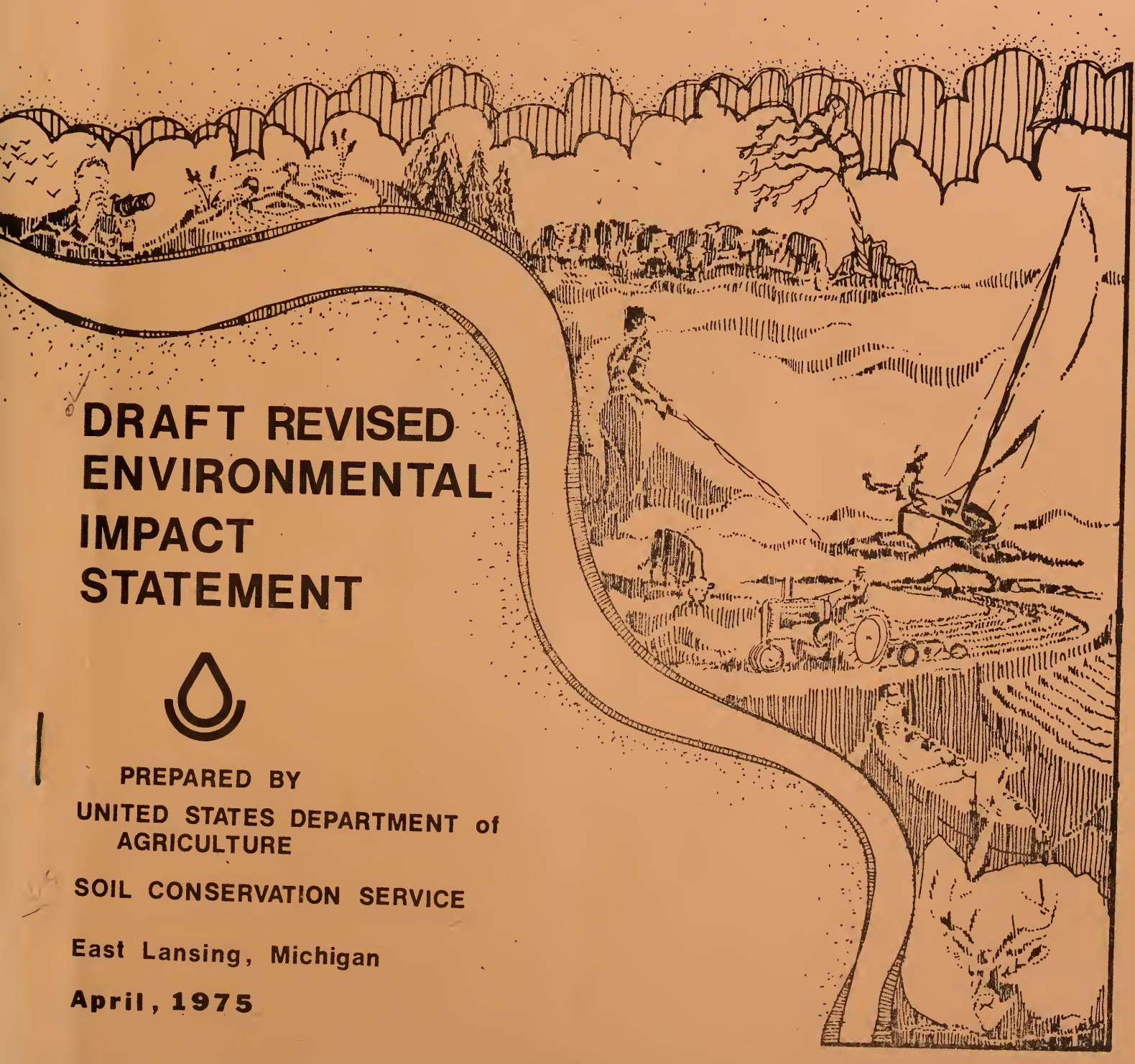
EAST UPPER MAPLE RIVER WATERSHED

SHIAWASSEE, CLINTON & GRATIOT COUNTIES

MICHIGAN



DRAFT REVISED ENVIRONMENTAL IMPACT STATEMENT

PREPARED BY
UNITED STATES DEPARTMENT of AGRICULTURE
SOIL CONSERVATION SERVICE
East Lansing, Michigan

April, 1975

USDA - SCS - EIS - WS-(ADM) - 75-3-D-MI

EAST UPPER MAPLE RIVER WATERSHED PROJECT

Clinton County
Gratiot County
Shiawassee County

State of Michigan

DRAFT REVISED ENVIRONMENTAL IMPACT STATEMENT

Arthur H. Cratty
State Conservationist
Soil Conservation Service

Sponsoring Local Organizations

Clinton County Soil Conservation District
100 South Ottawa
St. Johns, Michigan 48879

Gratiot County Soil Conservation District
124 South Maple
Ithaca, Michigan 48847

Shiawassee County Soil Conservation District
1767 South M-52
Owosso, Michigan 48867

Maple River Drainage Board
Courthouse
Ithaca, Michigan 48847

Drain 142 Drainage District
Courthouse
Ithaca, Michigan 48847

Drain 38 Drainage District
Courthouse
Ithaca, Michigan 48847

Bear Creek Drainage District
Courthouse
Ithaca, Michigan 48847

Middlebury-Cravens Drainage District
Courthouse
Corunna, Michigan 48817

Michigan Department of Natural Resources
Mason Building
Lansing, Michigan 48926

April 1975

Prepared By

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Room 101, 1405 South Harrison Road
East Lansing, Michigan 48823

REVISED

USDA ENVIRONMENTAL IMPACT STATEMENT

EAST UPPER MAPLE RIVER WATERSHED

Clinton County
Gratiot County
Shiawassee County

Michigan

Prepared in Accordance with
Sec. 102 (2) (C) of PL 91-190

SUMMARY

I. Draft
II. Soil Conservation Service
III. Administrative

IV. Description of Purposes and Action:

This project was planned and will be installed under the authority of Public Law 83-566, 83rd Congress, 68 Stat. 666, as amended. The East Upper Maple River Watershed is located in Clinton, Gratiot and Shiawassee Counties of Michigan. The purposes of the project are watershed protection, flood prevention, and improved drainage on agricultural land, recreation development, and public fish and wildlife development.

Project measures included are conservation land treatment on 31,865 acres, 43.9 miles of multiple-purpose channel, 2.0 miles of channel suction dredging, 1.1 mile of floodway, 11.7 miles of flood control levee, 10.6 miles of multiple-purpose collection channels next to the levees, and two pumping stations. Also planned are one single-purpose floodwater retarding dam, one recreational development with basic facilities and one fish and wildlife development with a water resource improvement and access facilities.

The river and tributaries included in the channel work have been previously modified, mostly between 1905 and 1915, and have perennial flow. Upper reaches of some tributaries have intermittent flow. Cover conditions along the river include areas of former cropland, brush lands, wooded areas and reaches with a single row of trees. Major marsh areas near the river below Bannister will be maintained within levees.

V. Summary of Environmental Impacts

Adequately treat 31,865 acres of cropland, pasture land against erosion.
Reduce average annual watershed erosion rate from 3.1 tons per acre to 2.5 tons per acre.
Reduce sediment load transported in channels 40 to 60 percent.
Reduce surface water runoff in the watershed by 4 to 6 percent.
Improve agricultural efficiency on 28,400 acres of crop and pasture land.
Reduce annual fuel consumption on cropland by 43,500 gallons.
Provide additional food and cover for wildlife as a result of conservation land treatment.
Reduce flood damages received by 210 landowners on 13,600 acres.
Improve drainage on 23,500 acres.
Reduce flooding to about 4,200 acres of terrestrial wildlife cover outside of levees and channels.
Reduce residential flood damages by $1,700 annually.
Reduce annual road and bridge flood damages by $4,500.
Reduce sediment leaving the watershed by 70 percent from 15,440 tons per year to 4,500 tons per year.
Convert 2,325 acres of pasture, idle and forest land to crop production.
A change in use of 39 acres of forest land, 52 acres of grass land, and 111 acres of cropland to 145 acres of grass land, 50 acres of water area, and 7 acres of gravel road surfaces.
Increase wildlife "edge effect" on about 95 acres.
Increase numbers of ground-nesting birds and small rodents in the vicinity of channels and levees.
Create new wildlife cover by building brush piles between the levees.
Reduce mosquito breeding on 23,500 acres of land.
Add 591 acres of new public land managed for fish and wildlife.
Improve river depth for canoeing on 2 miles of river.
Provide new recreation opportunities (picnicking, camping, swimming, hunting, fishing, canoeing) for 1,016,930 recreation visits.
Provide project benefits of $2,642,400 in the local economy.

Increase erosion and sedimentation during installation of structural measures.
Increase sedimentation and turbidity in the Maple River during the construction period of five to seven years.
Reduction of wildlife habitat on structural measures (about 530 acres) for up to 3 years.
Create possible mosquito breeding area on 7 acres of new water in collection channel.
Reduce fish cover and lower densities of aquatic plants and invertebrates on 45.9 miles of river bottom for several years.
Displace wildlife during construction activity.
Increase in noise, air, visual, and solid waste pollution as a result of 1,016,930 additional recreation visits.
Decrease value of two acres of Type 7 wetland due to spoil deposits.
Loss of nonrenewable fuel used during the construction period and the operation of pumping stations.
Increase in flood flows and flooding in the State Game Area below Highway 27.
Possible increase in stream water temperatures.
Decrease total forest land by 1,320 acres.

VI. Alternatives

1. Accelerated land treatment.
2. Purchase of flood plain.
3. Dike river and pump agricultural areas.
4. Two flood control structures only.
5. Dike and pump between Ovid and DuPlain.
6. No project action.

VII. Agencies from which Comments Have Been Requested:

Department of Agriculture - Office of Equal Opportunity
Department of the Army
Department of Commerce
Department of Health, Education, and Welfare
Department of the Interior
Department of Transportation

Environmental Protection Agency
Advisory Council on Historic Preservation
Federal Power Commission
Great Lakes Basin Commission
Governor of Michigan
State Clearinghouse
Tri-County Regional Planning Commission
East Central Michigan Planning and Development Regional Commission
GLS Regional Planning and Development Commission
Natural Resources Defense Council
Friends of the Earth
Environmental Defense Fund
National Wildlife Federation
National Audubon Society
Environmental Impact Assessment Project
USDA Agriculture and Stabilization Service - Michigan
USDA Farmers' Home Administration - Michigan
Michigan Senate - Agriculture Committee
Michigan Senate - Conservation Committee
Michigan House of Representatives - Conservation Committee
Michigan House of Representatives - Drainage Committee
Michigan Department of Agriculture
Michigan Department of Agriculture - Soil & Water Conservation Division
Michigan Department of Natural Resources
Michigan Soil Conservation Districts, Inc.
Michigan State University - College of Agriculture and Natural Resources
University of Michigan - School of Natural Resources
Cooperative Extension Service
Clinton County Board of Commissioners
Gratiot County Board of Commissioners
Shiawassee County Board of Commissioners
Grand River Watershed Council
Michigan State Chamber of Commerce
Michigan League of Women Voters
Michigan Association of Conservation Ecologists
Michigan Audubon Society
Michigan Botanical Club, Inc.
Michigan Natural Areas Council
Michigan United Conservation Club
Sierra Club - Conservation Committee

The Nature Conservancy - Michigan Chapter
Trout Unlimited, Michigan Council
West Michigan Environmental Action Council
Michigan Student Environmental Confederation
Gratiot County Herald
Lansing State Journal
Flint Journal
Consumers Power Company
Mid-Michigan District Health Department
Wilber Smith and Associates
Research Institute of Michigan
Michigan State University - Resource Development Department
Michigan Farm Bureau - Legislative Council

VIII. An environmental impact statement was prepared and submitted to CEQ on August 11, 1970.

CONTENTS

Page

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

USDA SOIL CONSERVATION SERVICE
DRAFT REVISED
ENVIRONMENTAL IMPACT STATEMENT

FOR

The East Upper Maple River Watershed
Clinton, Gratiot, and Shiawassee Counties
State of Michigan

Installation of this project constitutes an administrative action. Federal assistance will be provided under authority of Public Law 83-566, 83rd Congress, 68 Stat. 666, as amended.

SPONSORING LOCAL ORGANIZATIONS

Clinton County Soil Conservation District
Gratiot County Soil Conservation District
Shiawassee County Soil Conservation District
Michigan Department of Natural Resources
Maple River Drainage Board
Drain 142 Drainage District
Drain 38 Drainage District
Bear Creek Drainage District
Middlebury Cravens Drainage District

PROJECT PURPOSES AND GOALS

The goals of the sponsoring local organizations are to protect the watershed through increased conservation land treatment; flood prevention; improved agricultural drainage on existing crop and pasture lands; and increased public fish and wildlife and recreational opportunities.

Conservation land treatment measures will help fulfill the sponsors' goals of reducing runoff, erosion, and sediment; improving production efficiency on crop, pasture, and forest land; and improving fish and wildlife habitat for increased recreational and aesthetic enjoyment. Land treatment objectives are to maintain or improve soil productivity by adequately protecting cropland, pasture, forest land, and other land. Following are specific goals: reduce overall surface runoff; reduce gross sheet erosion for the watershed to an allowable rate; reduce sediment leaving the watershed; increase agricultural efficiency on cropland; reduce fossil fuel consumption as a result of minimum tillage; and improve recreational and aesthetic resources in the watershed.

Goals of the sponsors are to reduce flooding along the Maple River, Middlebury-Craven's Drain, Drain 142, Drain 38 and Bear Creek (Gratiot County). It is a goal to protect the lands which flood from a 2-year frequency event. It is desired to decrease annual flooding of county roads, bridges, and farmstead residences.

Another goal is to improve drainage on crop and pasture land. This will increase the agricultural efficiency of use of land, labor, and capital by allowing farmers to get into their fields sooner. More intensive use of the land will result, crop yields will increase, and crop quality will improve. The types of crops grown in the problem area require moderately well drained soils and cannot tolerate saturated soil moisture conditions for an extended period of time. To obtain maximum yields these crops must be planted as early as possible in the spring to utilize the full length of the growing season. This goal will realize expected yield increases of 7.0 tons (per acre) for corn silage, 47 bushel for corn grain, 29 bushel for wheat, 45 bushel for oats, 18 bushel for soybeans, 9 bushel for white beans, 6 tons for sugar beets, 1.7 tons for hay, and 50 cow pasture days for pasture.

The goal for wildlife is to protect and manage plant and animal resources in the flood plain. This will provide improved and controlled waterfowl habitat. Another goal is to provide public access to the area for fishing and hunting.

Providing water based outdoor recreation is a final goal of the sponsors. Swimming, picnicking, camping and boating opportunities for residents of southcentral Michigan are desired.

PLANNED PROJECT

East Upper Maple River Watershed is located in south-central portion of lower Michigan. It includes 169,730 acres which is 71 percent in cropland, 10 percent pasture, 11 percent forest and 8 percent in other uses. Principal problems are flooding and impaired drainage on agricultural land, erosion, and lack of public recreation areas.

Project measures include land treatment on nearly 32,000 acres, about 47 miles of channel work, nearly 12 miles of levees, two pumping stations, and a single-purpose flood retarding structure, and two recreational areas. Within the channel work segment is about one mile of floodway. Since the project was authorized for construction in October 1970 the multiple-purpose dam at Sleepy Hollow has been constructed creating a 421 acre lake and work has started on the recreational area associated with the lake. The land treatment program has also been accelerated.

LAND TREATMENT MEASURES

Currently there are 76,000 acres in the watershed which are adequately protected (soil, water and plant resources are adequately protected from deterioration, either naturally or by action of the land uses). The land treatment program planned to be installed during the 10-year (1971-1981) project period includes practices that will adequately treat an additional 27,800 acres of cropland, 2,450 acres of forest land, 650 acres of pasture land, and 965 acres of other land.

*All information and data, except as noted, were collected during watershed planning investigations by the Soil Conservation Service, and Forest Service of the U. S. Department of Agriculture. (Numbers in parenthesis refer to references listed in Appendix D.)

Land treatment measures will be installed on other areas in the watershed which will reduce erosion but may not be considered adequate protection.

Land adequately treated is land used within its capability and on which the conservation practices that are essential to its protection and planned improvement have been applied. The acres included in this plan to be treated are realistic goals based on past accomplishments and available technical assistance. Experience from other watersheds in Michigan shows that about 85 percent of the planned land treatment measures have been applied. Additional measures will also be applied to the land after the installation period as a part of the Soil Conservation Districts ongoing conservation program.

During the installation period, 183 new conservation plans will be prepared. A conservation plan is the properly recorded decisions of the cooperating landowner or operator on how he plans to use the land in his operating unit within its capability and to treat it according to its needs for maintenance or improvement of the soil, water, and plant resources. Assistance will also be provided in the preparation of forest land management plans for 40 landowners.

Practices to be applied on cropland include conservation cropping systems, crop residue use, critical area planting, grade stabilization structures, grassed waterways, minimum tillage, drainage mains or laterals, drainage field ditches, drains and wildlife upland habitat management. Treatment to be applied on pasture land include grade stabilization structures, grassed waterways, drainage mains and laterals, pasture and hay land management, pasture and hay land planting, drainage and field ditches, drains and upland wildlife habitat management.

Land treatment for forest land include tree planting, grazing control, and hydrologic cultural operations (forest vegetative cover improvement). Measures to be applied on other land include grassed waterways, ponds, and wildlife upland habitat management. Definitions of land treatment practices are given in Appendix D.

The establishment of the land treatment program is essential to the proper functioning of structural measures by reducing sedimentation from sheet erosion. This results in the reduction of operation and maintenance costs.

Installed land treatment measures will be maintained by the landowners, operators, and responsible land managers. Technical assistance will be made available to private landowners through the regular programs of the Clinton, Gratiot, and Shiawassee County Soil Conservation Districts in cooperation with the Soil Conservation Service and of the Michigan Department of Natural Resources in cooperation with the U. S. Forest Service under cooperative forestry programs.

STRUCTURAL MEASURES

Some of the structural measures planned include 43.9 miles of multiple-purpose channel, 2.0 miles of channel suction dredging, 1.1 mile of floodway, 11.7 miles of flood control levee, 10.6 miles of multiple purpose collection channels next to the levees, and two pumping stations. Also planned are one single-purpose floodwater retarding dam, one recreational development with basic facilities and one fish and wildlife development with a water resource improvement and access facilities. All stream channels were previously modified in the early 1900's with additional minor clean-out of parts over the years. (The location of these measures are shown on the Project Map in Appendix B.)

Included for the total works of improvement are the following construction items and estimated quantities: clearing and grubbing, 183.7 acres of woods and 346.4 acres of brush; stream channel, sediment basin and collection ditches excavation, 2,880,030 cubic yards; floodway construction, 108,000 cubic yards; levee construction, 361,200 cubic yards; embankment, compacted fill, 231,668 cubic yards; surface water inlet structures, 529; tile outlets, 250; permanent seeding and mulching, 511.4 acres; gravity flow pipe structures with flap gates, 18; and collection channel culverts, 12.

Daily seeding of all excavated channel side slopes will be done for the portion completed that day.

A permanent seeding and mulching with the same seed mixture will be applied to the levees, berms, spoil banks, borrow areas and other areas exposed including repairing daily seedings after completion of the final shaping operation. All disturbed areas will be seeded to prevent erosion and to enhance wildlife use. Trees and brush cleared for the

project will be piled between the levees and anchored securely to resist flood flows. These piles of brush will be for the use of wildlife. (See Figure 1.)

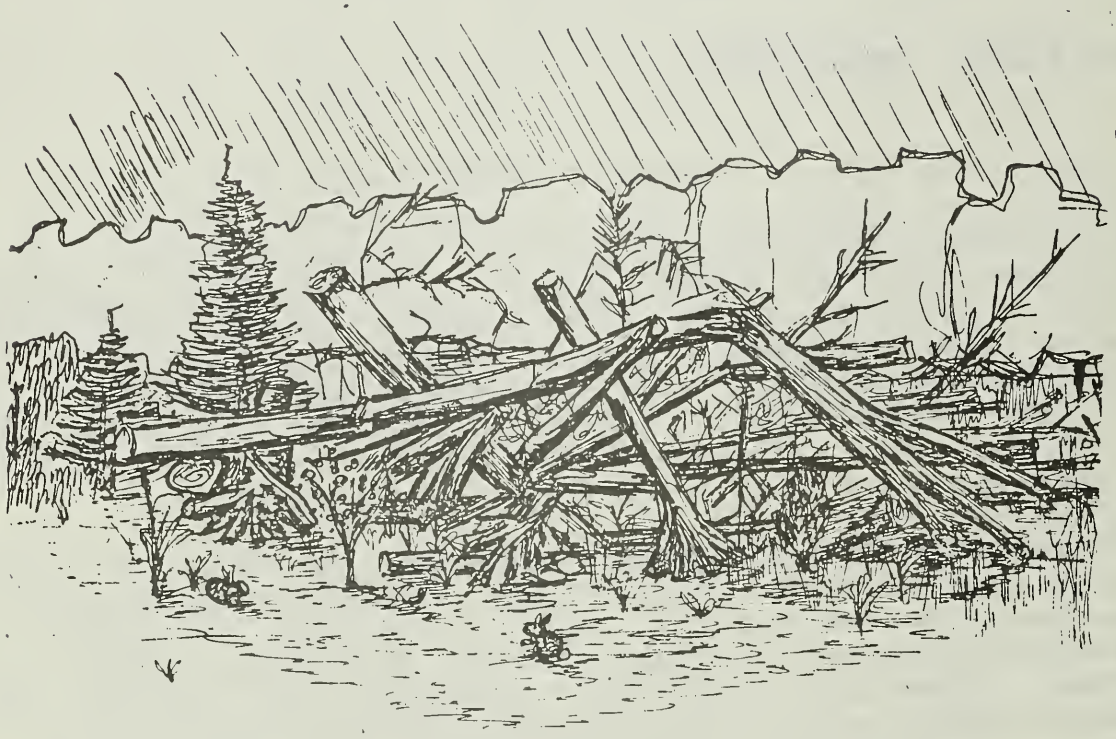


FIGURE 1 - WILDLIFE BRUSH PILE

Requirements for safety and health in conformance with the Federal Construction Safety Act of 1969 (PL-91-54) will be included in each construction contract. Design and construction of all measures will comply with applicable State laws regarding safety, health, sanitation, and erosion control.

Project measures in the East Upper Maple River Watershed have been reviewed with the Michigan State Historic Preservation Officer. A letter is on file from the State History Division reviewing the coordination which will be carried out in this project. They have agreed to the procedures and will periodically review the progress of future work.

A literature search by a qualified archeologist from Michigan State University has revealed eighteen archeological sites which appear to lie in the vicinity of planned project measures. Field investigations are underway to determine if any sites are endangered by the project and if salvage work is necessary. If any need for salvage becomes apparent, the U. S. Department of Interior, National Park Service and the Michigan Department of State, Division of History will be informed. No construction will take place until after the archeologist field study report has been reviewed by the History Division and any required salvage work is completed. If later construction activities uncover any artifacts of significance in areas other than these surveyed, the Historic Preservation Officer and the National Park Service will be notified. This is in accordance with the provisions of the Reservoir Salvage Act of 1960 (PL-86-523) as amended and supplemented by the Archeological and Historical Preservation Act of 1974 (PL-93-291).

There are no known properties included in or eligible for inclusion in the National Register of Historic Places within the construction area. There will be no change in the existing responsibilities of any Federal agency under Executive Order 11593 with respect to archeological and historical resources.

SINGLE PURPOSE STRUCTURE - BEAR CREEK

A single-purpose floodwater retarding structure is planned for Bear Creek, Shiawassee County. The drainage area of this site is 29.3 square miles (18,752 acres) which will control approximately 9.6 percent of the entire watershed area. This structure is designed as a flow through dam with no permanent water storage. (See Figure 2.)

However, there will be storage available behind the dam to allow the accumulation of 50 years worth of sediment (265 acre feet). In addition, 4,165 acre feet of floodwater storage will be provided. This will create a temporary pool up to 410 acres. After 50-year period, sediment accumulation will slightly reduce the flood protection provided by the site.

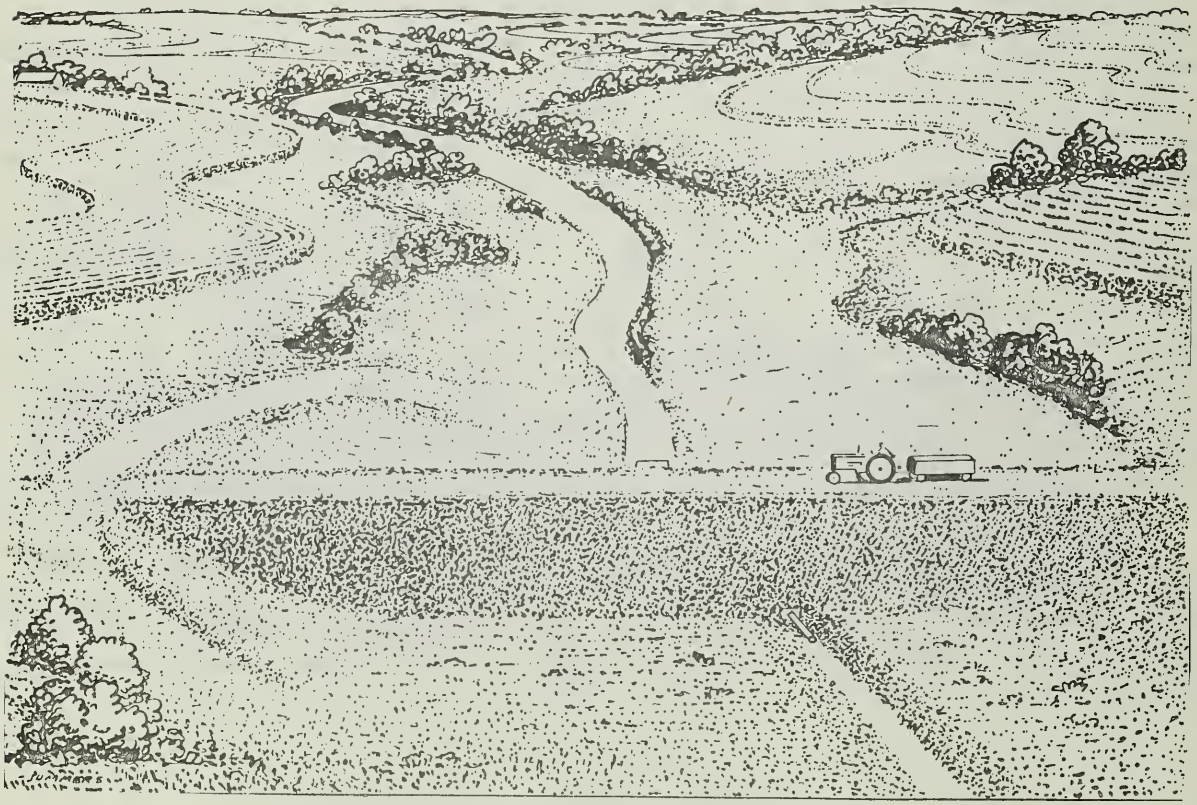


FIGURE 2 - FLOOD RETARDING DAM-DRY POOL

When constructed this dam will be 1,500 feet long, 34 feet high, and contain 135,000 cubic yards of compacted earth fill. Material needed for construction will be excavated from the 400 foot bottom width emergency spillway around the side of the dam. Earth spillways allow for safe passage of water from excessive storms around the embankment (dam). The crest of the emergency spillway will be set at an elevation so that flow will not occur through it more frequently than an average of once every 50 years. Once constructed the emergency spillway as well as the dam and other construction areas will be seeded to prevent erosion. Approximately 50 acres will be cleared for this structure.

From the preliminary foundation investigations it has been determined that mixed soil conditions exist. No particular problems are anticipated in the construction of the principal spillway or the earthfill.

The principal spillway system will consist of a reinforced concrete pressure pipe conduit with a riser and an energy dissapating impact basin. (See Figure 3.) The principal spillway will be constructed so as to not permanently impound water above the dam. The maximum release rate for the principal spillway is 430 cfs.

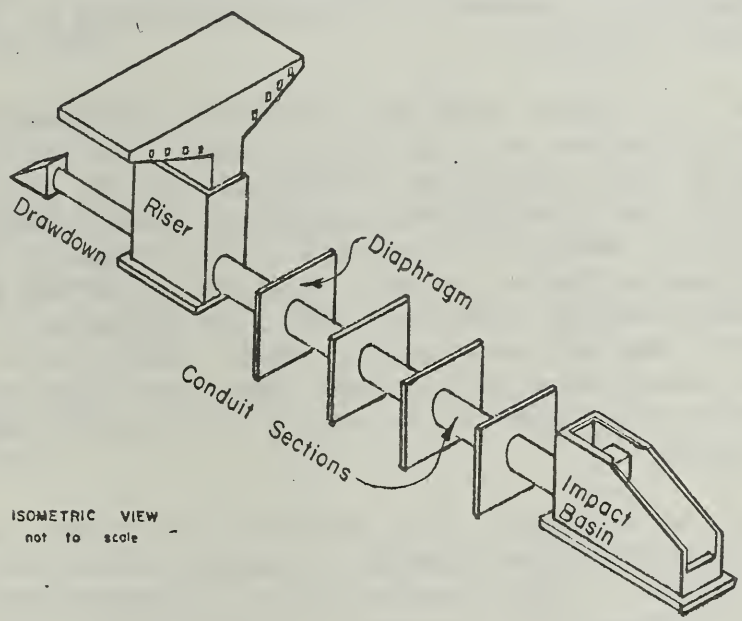


FIGURE 3 - BEAR CREEK PRINCIPAL SPILLWAY SYSTEM

MULTIPLE PURPOSE CHANNEL - UPPER SECTION

Approximately 25.0 miles of channel work will be done on the Maple River and 4.2 miles on the Middlebury-Cravens Drain in the upper end of the watershed. (See Appendix B.) Planned work on the Maple River extends from St. Clair Road north of Rochester Colony in Clinton County to Lemon Road southeast of Corunna in Shiawassee County. Middlebury-Cravens Drain extends from Baldwin Road east of Ovid to its intersection with the Maple River south of M-21. All channels scheduled for excavation have been previously modified. A trapezoidal channel shape will be used with 2:1 side slopes and bottom widths ranging from 4 to 75 feet. (See Table 1.) A low flow segment will be built into most channel segments. Soil investigations and analysis indicates spot protection against instability is needed. Critical areas will be stabilized using stone rip-rap or gravel.

Excavation of the channel from one side only is planned in most areas. Using this procedure one side of the channel is left undisturbed while clearing and spoil spreading is confined to the other side. This reduces the required clearing and resulting effect upon the vegetation. Three forested areas of interest will be avoided by this procedure--Ovid to Rochester Colony, a short segment in Sections 19 and 30 of Owosso townships and in Sections 4 and 5 of Shiawassee township. One side construction may not be practical when: constructed channel is large so equipment cannot move soil in one operation; bank stability problems require that both banks be excavated or excessive amounts of spoil are to be spread.

Pools with several boulders, logs cabled to the banks, and low flow channels are measures being planned at several points to restore former game fish habitat. Other possibilities of further protecting fish habitat in the Shepardsville-Rochester Colony area by selective excavation are being explored.

The 4.2 miles of channel work on Middlebury-Cravens Drain will have bottom widths of from 4 to 7 feet and side slopes of 2:1. Excavation will be from one side only through most of this reach. Design flow depth will be 5 feet.

TABLE 1 - Proposed Channel Segments-Maple River Upper Section

Channel	Approximate Length (Miles)	Design Depth (Feet)	Bottom Width (Feet)
St. Clair Road	3.8	7.2	75
Harmon Road	0.7	6.8	72
Farrager Road	0.8	6.6	54
1645 West of Shepardsville Road	1.8	6.4	45
Alder Creek (0.75 mi. west of Ovid)	10.9	6.2	32-38
State Highway M-52	0.9	5.8	26
Spring Brook Creek	1.8	5.6	16
Cook Road	1.0	5.4	14
1320 Feet East of VandeKarr Road	3.3	5.2	4-6
Lemon Road			

LEVEES

Levees will contain the river flows on the main stem between Wilson Road below the town of Bannister and the end of the watershed area at the Bear Creek (Gratiot County) junction, and on the Bear Creek between its junction with the river and the Grand Trunk Railroad. A total of 11.7 miles of levee will be built. Tie-back levees on Bear Creek will eliminate pumping on 25.0 square miles of drainage area by routing its flow directly into the levee system. (See Figure 4.)

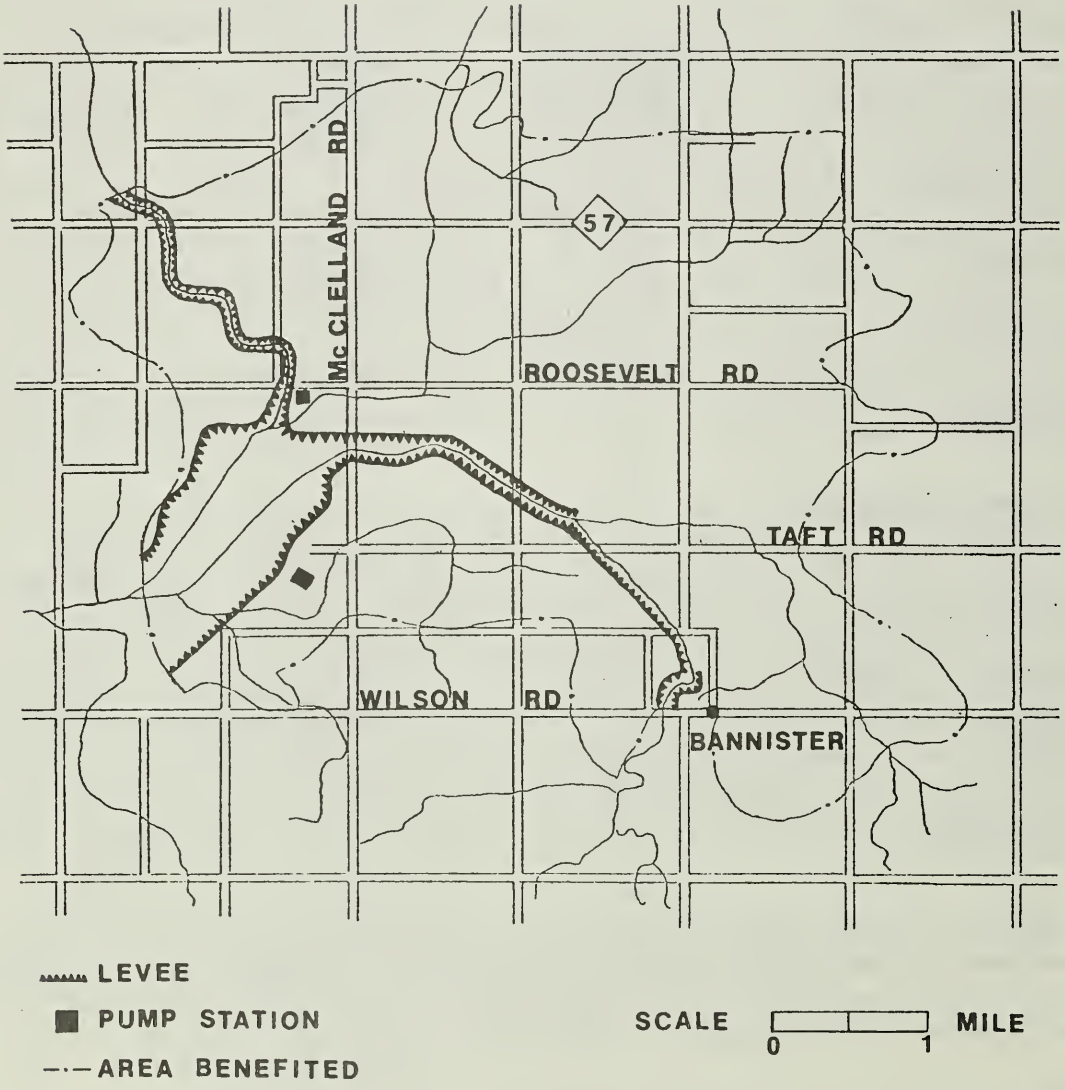


FIGURE 4

LOCATION – LEVEES and PUMP STATIONS

All leveed sections will contain the runoff from a 25-year frequency flood with two feet of freeboard. Top width is planned to be 8 feet, side slopes 3:1, and the height of levee will be up to 10 feet with the average about 6 feet. (A 6-foot high levee will be 44 feet wide at the bottom.)

An overflow or spillway area is needed in the Maple River levee system which will be accomplished by lowering the top of the levee 8 to 12 inches below the planned elevation in selected locations. This will provide a controlled location and will minimize damage to the levees if a frequency storm exceeding the 25-year design should encroach upon the freeboard to the point of overflowing. The location of the control sections will be determined during final design.

Additional fill material for levees not readily available from adjacent collection channel construction may be taken from borrow areas located between the levees. When possible these areas will be constructed to form potholes for additional wildlife habitat, or be shaped and seeded to grasses after removal of the fill material.

Below McClelland Road the levees will be located away from the river to avoid identified wetlands and to preserve prime wood duck habitat. (See Figure 5.) There is to be an average of 1,800 feet between the levees in this segment. This location will avoid much of the wooded flood plain and put levees more on cropland.

Underlying sands in parts of the leveed area may cause a piping problem between the river and the collection channels during the higher flood stages. A gravel filter blanket will prevent this internally caused bank erosion. About 1,200 feet of this condition exists where the levee will cross Newsom Drain near the intersection of Wisner and Grendlund Roads. Another area exists about 3,300 feet on the west side of the river between Wilson Road and Grendlund Road near Bannister.

COLLECTION CHANNELS

A collection channel system will be constructed outside each levee to carry the runoff water from a 2-year frequency flood to the pumping stations. Collection channels will have the depth to furnish drainage outlets for adequate drainage for all crops grown in the surrounding area. Bottom widths will vary from 4 to 30 feet and depths from 5 to 15 feet. Collection channel culverts will provide access to levees for maintenance.

FIGURE 5 - TYPICAL CROSS-SECTION OF FORESTED FLOOD PLAIN, LEVEE AND COLLECTION CHANNEL

Figure 6 shows a typical collection channel crossing. The 10.6 miles of collection channels to be constructed outside of the levees are new channels through primarily agricultural cropland.

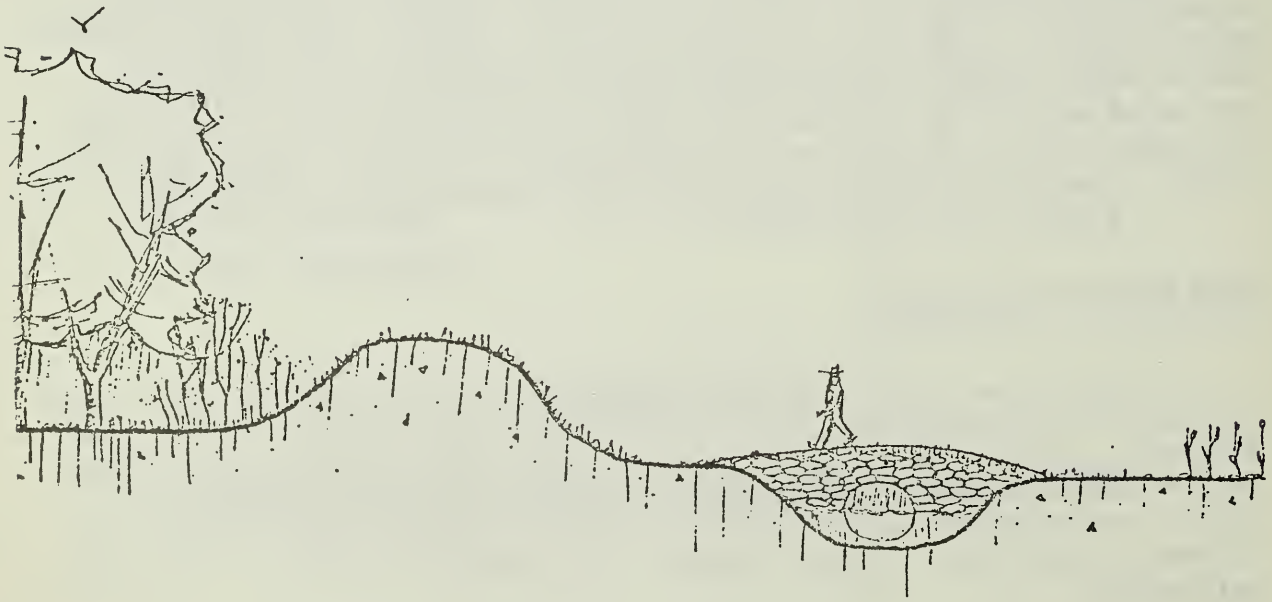


FIGURE 6 - CROSS-SECTION OF LEVEE AND COLLECTION CHANNEL CROSSING

PUMPING STATIONS

To achieve drainage of the areas protected by the levees, two pumping stations will be installed to remove the surface runoff and sub-surface drainage water. (See Figure 4 and 7.) From a hydrologic and economic study it was determined that the optimum pumping rate would be one-half inch in twenty-four hours. At that rate the pumping capacities of the two pumping stations are as follows: station near Roosevelt and McClelland Road, 115,900 gallons per minute; and the station near McClelland and Taft Roads, 31,710 gallons per minute. Total pumping capacity is 147,610 gallons per minute and covers a total drainage above the pumps of approximately 22.1 square miles.

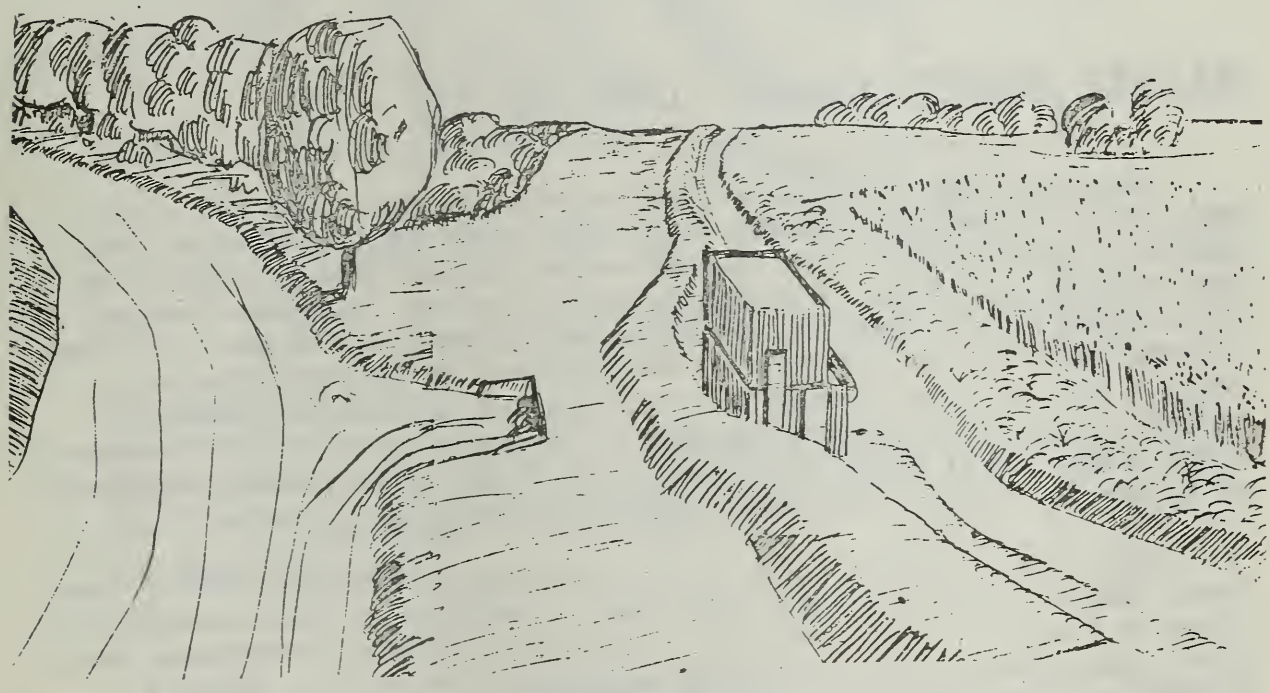


FIGURE 7 - LEVEE, PUMPING STATION AND COLLECTION CHANNEL

The pumping stations will be of modern design, unobtrusive concrete block construction and extend to a height of approximately 22 feet above levee top elevation. The stations are located adjacent to wooded areas to minimize visual dominance and powered by electric motors to keep noise levels low and reduce operator costs. Overhead power lines will bring electricity into each pumping station. The Roosevelt Road and Taft Road pumping stations will require construction of all weather access roads to service the pumps of approximately 300 feet and 1,000 feet, respectively.

Three 42-inch pipes are planned to be a part of Roosevelt Road pumping station and two 30-inch pipes are planned for the Taft Road station. All pipes will have flap gates to prevent backwater problems during high flows on the Maple River. These pipes will allow drainage of the collection ditch without pumping when the river is at low stage.

MULTIPLE PURPOSE CHANNEL - LOWER SECTION

There will be 3.7 miles of channel work in the lower end of the Maple River extending from 800 feet south (upstream) of Wilson Road, Bannister downstream to 300 feet below McClelland Road. Included in this segment is 1.1 miles of floodway development. Suction dredging of the channel will be done on 0.9 miles of the Maple River and 1.2 miles of Bear Creek in the vicinity of the junction of the two streams. Channel work is also planned for 8.2 miles of Bear Creek (Gratiot County), 1.9 miles on Drain 38, and 2.0 miles on Drain 142. The Bear Creek segment will begin 1,200 feet downstream of Roosevelt Road south of Ashley and continue upstream approximately to U. S. Route 27.

Maple River channel work, suction dredging, and 2.2 miles of Bear Creek channel will be within the levees. Location of the measures is given in Figure 8. The work will consist of widening, deepening, and minor realignment. Land right-of-way will be obtained to allow a minimum 20-foot berm for maintenance work.

The lower 2.0 miles of channel work on the Maple River will have a 150-foot bottom width. A low flow channel will be constructed within the main channel and will have 40 foot bottom width and three (3) foot depth. (See Figure 9.) The channel will generally follow the present stream alignment. This low flow channel will concentrate normal summer

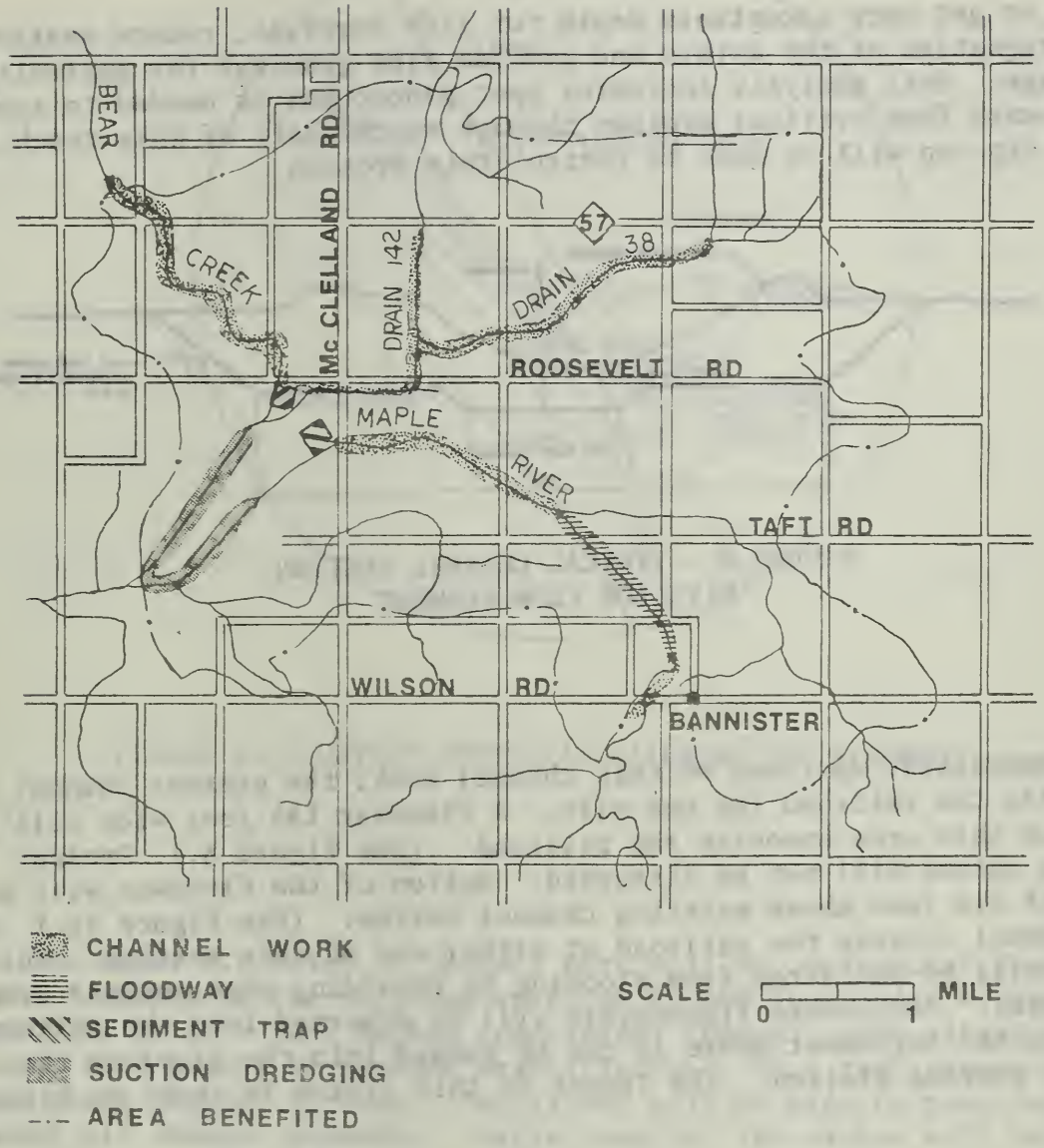


FIGURE 8

LOCATION-LOWER MULTI-PURPOSE CHANNELS

flows to get more acceptable depth for fish survival, reduce heating and stagnation of the waters and provide flow gradient for agricultural drainage. Soil analysis indicates spot protection is needed to stabilize banks from critical erosion through nearly half of this reach. Stone rip-rap will be used to control this erosion.

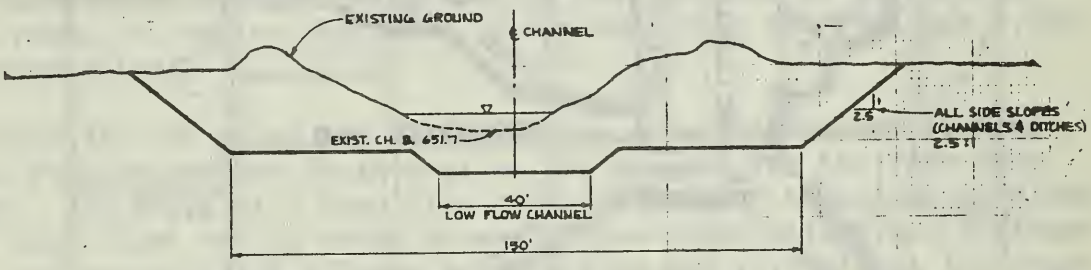


FIGURE 9 - TYPICAL CHANNEL SECTION
WITH LOW FLOW SEGMENT

Immediately upstream of this channel work, the present channel parallels the railroad for one mile. A floodway 185 feet wide will be built in this area opposite the railroad. (See Figure 8.) Present channel bottom will not be disturbed. Bottom of the floodway will be at least six feet above existing channel bottom. (See Figure 10.) An old channel crossed the railroad at either end of this section. This ox-bow will be protected from flooding by providing pipe outlets with flap gates. Any excess floodwaters will be diverted into the collection ditch to the northwest where it can be pumped into the river by the planned pumping station. The layout of this system is shown on Figure 11.

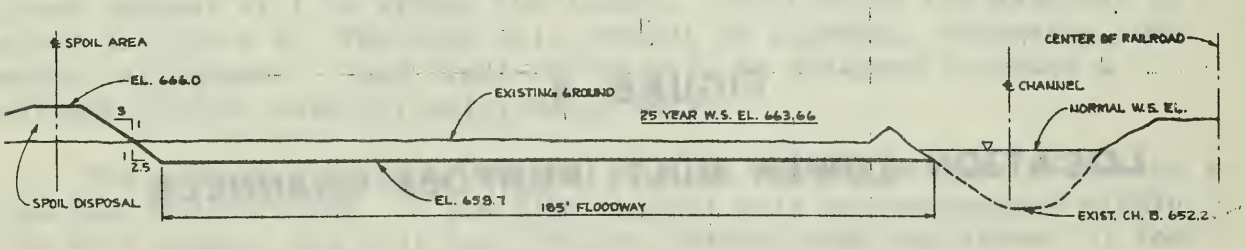


FIGURE 10 - TYPICAL SECTION FLOODWAY

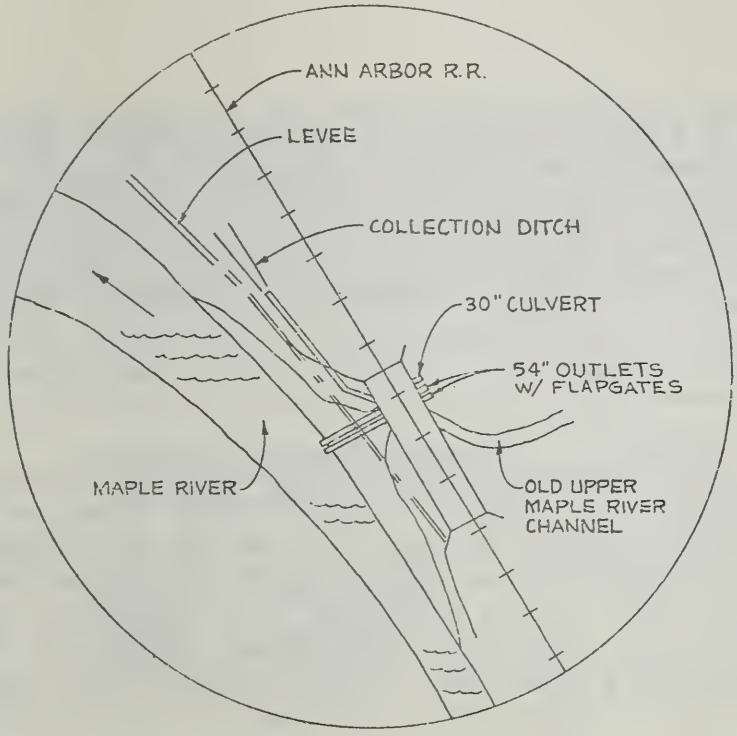


FIGURE 11 - OUTLET SYSTEM AT RAILROAD AND FLOODWAY

The upper 0.6 miles of channel work will be constructed from end of the floodway at the railroad upstream to 800 feet above Wilson Road. There will be a 75 foot bottom trapezoidal channel, with slight curves armored with gravel to provide stabilization. This realignment will cross three natural ox-bows. Provisions will be made to pass low flows through old channel segments. Outlet ends of the ox-bow will be protected from eroding where necessary.

All of these sections of channel work will have 2.5:1.0 side slopes and grass vegetation established on all construction areas.

Channel work on Bear Creek, Drain 142 and Drain 38 will total approximately 11.9 miles of widening and deepening. (See Figure 8.) It will generally follow the present alignment of the channel. A trapezoidal channel shape will be used in this area. Side slopes will be 2:1 except in the 80 foot bottom width segment which will be 2.5:1. Table 2 indicates the channel segments and planned bottom widths.

TABLE 2 - Proposed Channel Segments
Bear Creek, Drain 142, Drain 38

Segment	Approximate Length (Miles)	Design Depth (Feet)	Bottom Width (Feet)
Bear Creek			
1,200 ft. S.W.Roosevelt Rd.			
	2.2	7-11	80
Grand Trunk Western R.R.			
	1.1	5.3	40-50
1,350 Ft.N. of Garfield Road			
	3.2	5.3	16-20
3,000 Ft. W. of Crapo Road			
	1.7	5.2	10-12
U. S. Route 27			
Drain 142			
Confluence with Bear Creek			
	1.2	5.0	60
Confluence with Drain 38			
	0.8	5.0	24
State Route M-57			
Drain 38			
Confluence with Drain 142			
	1.9	5.0	20
East of Barry Road			

Two permanent sediment basins will be constructed in the lower channel area. One is located on the Maple River at the lower end of the channel work, approximately 300 feet below McClelland Road. The second is on Bear Creek where the channel work ends and the suction dredging begins, about 1,300 feet below Roosevelt Road. They will be built adjacent to the channel to collect sediment which may be carried downstream during construction. After construction is completed the traps will be maintained so as to protect the downstream areas from sedimentation.

Suction-type channel dredging will be done on 0.9 miles of the Maple River, previously modified prior to 1903, starting from the west watershed boundary line and on 1.1 miles of the Bear Creek channel starting at the confluence of Bear Creek and the Maple River. Deepening of 2-3 feet is necessary to furnish a gravity outlet for drainage of areas in the East Upper Maple River Watershed. This work will substantially reduce the pumping time for the pumping stations in the watershed during periods of low flow on the Maple River.

The use of a suction-type floating dredge will allow shoreline wildlife habitat disturbance to be kept to a minimum along this part of the channel. Existing channel banks will not be excavated. Since the work area will be primarily within the river, there will be little disturbance of adjacent vegetation. Spoil disposal areas will not need to be cleared. Suction dredged materials will be transported by pipeline to selected disposal areas. This method will also reduce downstream sedimentation during construction.

Suction-type channel dredging will be done adjacent to Type 6 and 7 wetlands in the flood plains, however, these wetlands will not be drained. Present natural river banks and old spoil areas will prevent drainage of most of the wetland areas. Low levees will be placed along the channel as necessary to protect areas from draining. Low land behind the old spoil areas will act as sediment basins for the dredged material.

Prior to suction dredging on the Maple River detailed sampling and sediment analyses will be made to determine if the material is polluted. Consultation with the Michigan Department of Natural Resources and EPA guidelines will be made to determine if special precautions are needed in handling dredged materials.

Approximately 18,000 cubic yards of dredged material will be spread out over 105 acres, of which most all of the area is Type 6 or 7 wetlands. Dredge discharge pipe will be placed in specified areas 100 to 200 feet away from the channel bank. Locations for spoil placement have been coordinated with MDNR. Deposits are expected to be less than 3 inches deep over 98 percent of the sediment basin area and up to 24 inches deep over about 2 acres (mainly where the dredge discharge pipe is located). Materials deposited will be a mixture of water, silt, clays, and sands. The water returning to the channels will be essentially free of sediment, but may contain colloidal particles that could cause turbid water conditions.

As part of the suction dredging project, those trees which are in danger of falling in the river in the near future will be removed to prevent blockages and creating raw banks which could easily erode. Woody materials will be piled adjacent to the channel for wildlife cover.

Three temporary sediment basins are included in the dredging work to trap sediment during construction and after project completion. The basins are to be located at the confluence of Bear Creek and the Maple River, at the upstream end of the Maple River suction dredging work, and at the upstream end of the Bear Creek suction dredging work. All three basins will be 3.0 feet deeper than the proposed channel bottom elevation. These basins are entirely within the existing channel and thus require no additional channel width.

FISH AND WILDLIFE DEVELOPMENT

Collection channels, levees and the area between the levees (between Bear Creek and Bannister) which will be used for a public fish and wildlife development involves a total of 946 acres. Levees along the Maple River will be constructed on both sides of the flood plain and have widths between the levees varying from over 1,800 feet below McClelland Road to 150 feet in upstream areas. With this arrangement, most of the trees and natural vegetation along the channel will be preserved.

A total of 355 acres will be committed to levees, collection channels, and channel work. This area will be purchased by the Maple River Drainage Board for their operation and maintenance program. In addition the public fish and wildlife development between the levees will involve a total of 591 acres of privately owned land to be purchased by the Michigan Department of Natural Resources including 305 acres which will be cost-shared with Public Law 566 funds. This will tie in with the development planned in the West Upper Maple River Watershed.

Major recreational uses of the public fish and wildlife development include fishing; small game, deer and waterfowl hunting; trapping; hiking; canoeing; bird watching and photography. There will be 2 public access sites with sanitary facilities, including those for the physically handicapped. (See Appendix B.) Sanitary facilities will be of the vault type to prevent pollution of the water resources of the area. They will meet requirements of local and State health departments. One site will have parking for 10 cars with trailers and a boat ramp. (See Figure 12.) The other site will have parking for 10 cars and walk-in access to the river.

Gravel roads will be constructed for entry to the public access sites. Access rights-of-way to pumping stations will be widened and used for public access roads. Access to the area will be from existing county roads as follows: Taft Road on the south side, and McClelland Road on the northeast side.

The public fish and wildlife development facilities have been kept to a minimum to preserve the existing ecological community and physical features of the flood plain. In addition to the planned recreational facilities, water resource improvements are planned within the leveed area. These will consist of wildlife food plots (on previously farmed cropland), low dikes to allow flooding of these plots, and a water level control structure to manage the water levels in the plots and will cost an estimated $7,000.

Present land use of the 946 acres to be purchased and committed to structural measures and the public fish and wildlife development consists of the following: water areas, 9 percent; cropland, 24 percent; forest land, 47 percent; and grassland, 20 percent. All of the land is presently in private ownership. Most of the cropland is presently in corn and soybeans. The flood plain wildlife habitat and adjacent cropland receive substantial use by upland and wetland species of wildlife.

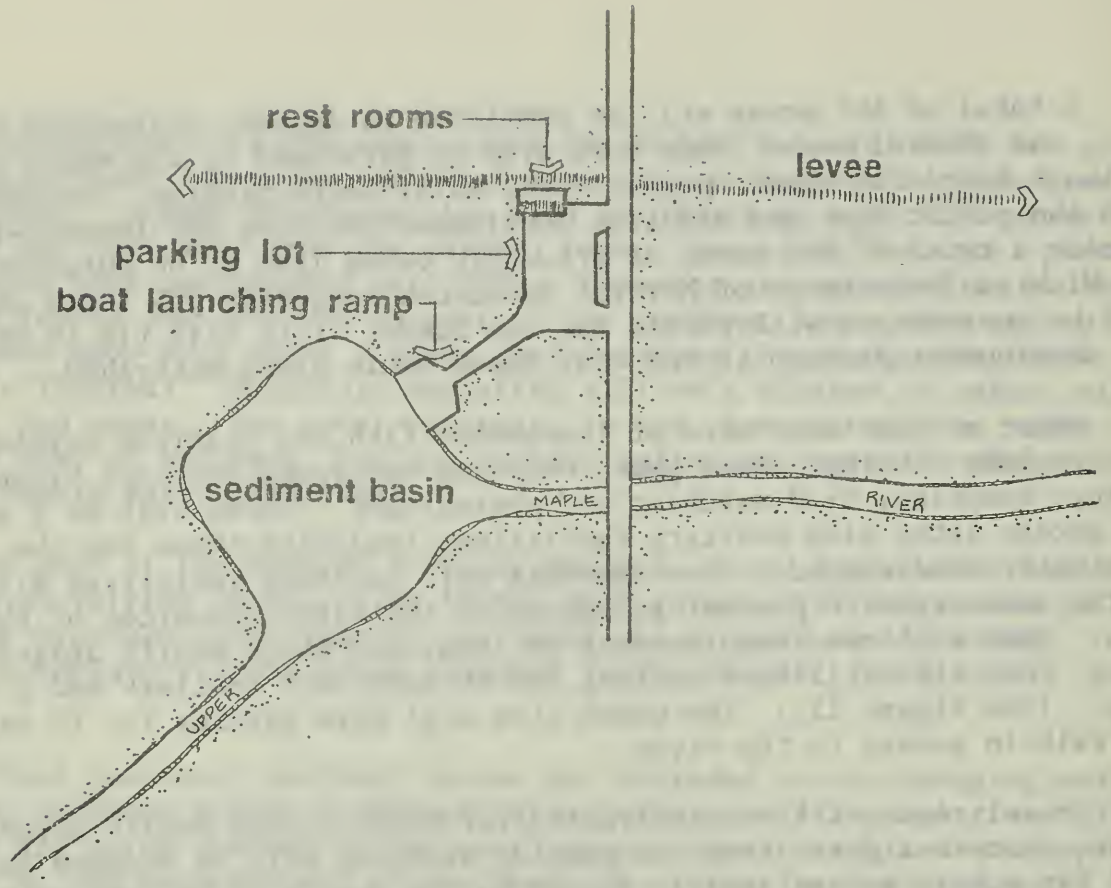


FIGURE 12 - FISH AND WILDLIFE PUBLIC ACCESS SITE

SLEEPY HOLLOW RECREATION AREA

Sleepy Hollow Recreation area on the Little Maple River contains 1,480 acres and is 1 mile wide by 3 miles long. (See Appendix B.) The topography is gently rolling and varies in elevation from 740 to 840 feet above the mean sea level. The Little Maple River flows through the site from south to north and is a tributary to the Maple River. A dam has been constructed to form a multiple-purpose lake. Several short intermittent streams join the Little Maple above the structure site. The water quality is considered to be good and will be satisfactory for swimming. It meets requirements of the State and local health agencies for the planned uses.

The main access to the area is Price Road. Realignment of approximately 3,000 feet was done on the curved section crossing the Little Maple River. A 15'-10" x 9'-10" multiple-pipe arch culvert was installed to carry a 50 year frequency storm.

The recreation pool area of 412 acres is about two miles long and a mile wide at its broadest point, and has approximately 7.0 miles of shoreline. Some shaping of the lake bottom was done prior to flooding to improve fish habitat. Shaping was done in the beach area to provide suitable dry and wet beach gradients. Deepening of the lake in some sections was done to improve water quality and will aid in the control of aquatic plant growth. Some sections of the main shoreline will be excavated to provide a rapid dropoff for improved fishing. The lake will be managed by the Department of Natural Resources for warm water species.

Major uses of the recreational area include camping, picnicking, fishing, swimming, boating, hiking, active games and nature studies. A general recreation plan for the area is shown on Figure 13.

There are 300 improved campsites planned for the northeast section of the area. All campers will have access to electricity, running water and modern toilet buildings with hot showers. The campers will have easy access to the beach, picnic, boating and other facilities. Adjacent hard surfaced parking lots are planned in several locations. Modern toilet buildings will be constructed to serve all picnickers. All facilities will be designed for use by the handicapped.

An improved boat launch site is planned for part of the lake north of Price Road to accommodate the number of boats that can be allowed on the lake at one time.

Other planned uses will be the development of nature trails for the hiker where the emphasis will be on the natural environmental character of the land. An interpretive nature center will provide appropriate displays and programs.

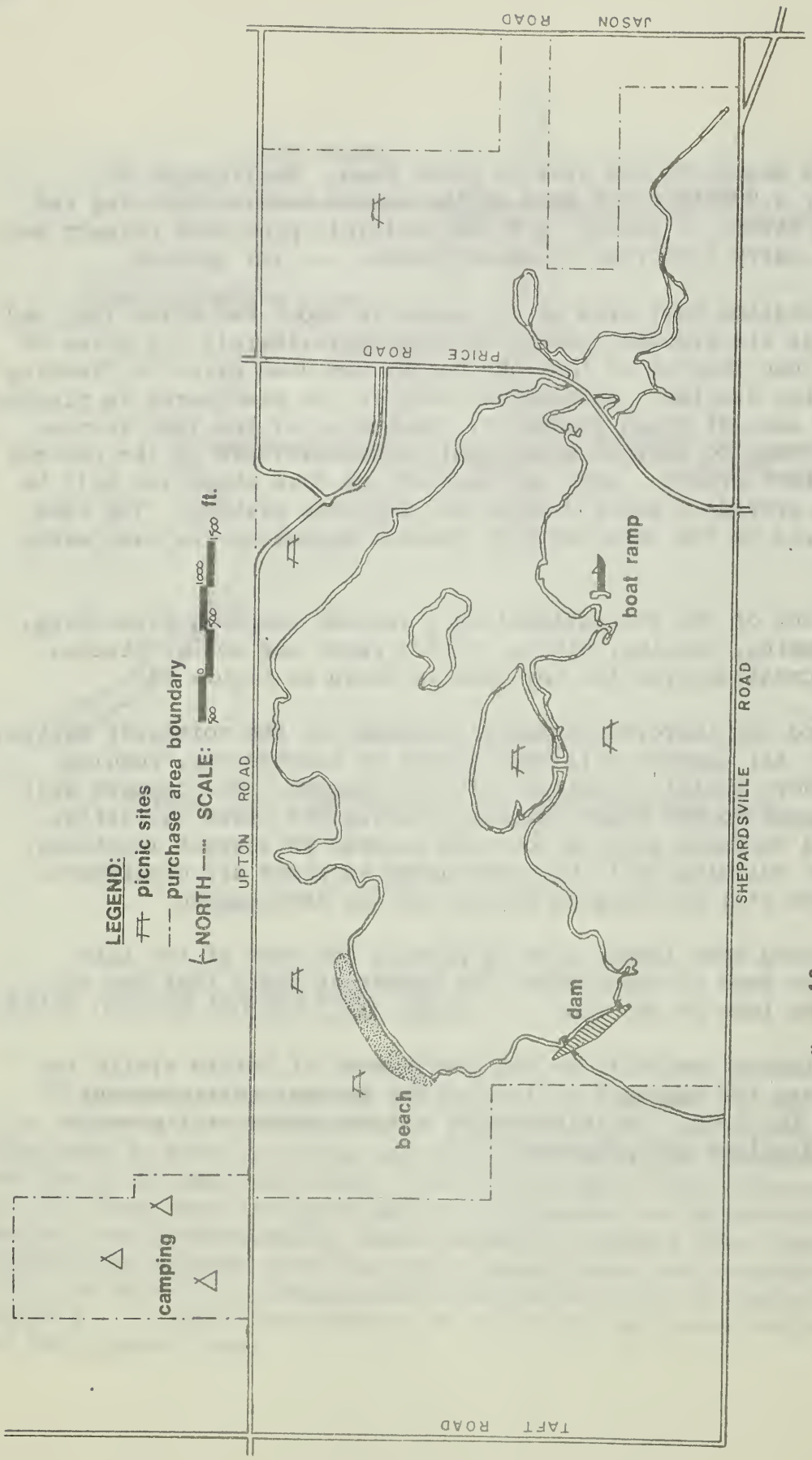


figure 13. SLEEPY HOLLOW GENERAL RECREATION PLAN

OPERATION AND MAINTENANCE

An establishment period not to exceed three years is provided for the structural work and associated vegetative cover. During this period the Soil Conservation Service may use PL-566 funds to cost share on any repairs or other work resulting from unknown site conditions or latent defects. Channels will be stable in the aged condition. Some segments may experience unstable conditions in the period immediately following the construction (up to three years) and require repair work. This has been identified as a possible condition on about 11.3 miles of Maple River in six segments, 1.3 miles on Bear Creek in three segments, and on the 4.2 miles of Middlebury-Cravens Drain. The degree of risk has been accepted by the Service and the sponsors as being preferable to further design measures. Cost of repairs will be shared between the sponsors and the Service in the same ratio as the original structure. It should be accomplished with expenditures not exceeding 10 percent of the reach construction costs. Type of work includes minor structural measures such as reshaping of the constructed channel and rock toes, and prompt establishment of adequate vegetative cover.

The continued functioning of the multiple-purpose channel work, levees, collection channels, and pumping stations in providing the degree of flood protection for which they were designed and for serving as adequate outlets will require a timely maintenance program. This will require the control of undesirable vegetal growth by mowing and/or spraying; resloping of eroding banks; removing sediment bars from channels; and removing debris from pipes, trash racks, and pumps.

To decrease or eliminate the need for major repairs or the replacement of the various parts of the impoundment structures, periodic checks and timely maintenance work are essential. Scour damage in the emergency spillway from local runoff or high frequency storm use will be repaired and stabilized by desirable vegetal growth. The principal spillway works will be checked for structural soundness and properly repaired if necessary. Undesirable vegetal growth and rodents will be removed from embankments. Debris caught in trash racks will be promptly removed.

The Maple River Drainage Board will operate and maintain the improvements on the Maple River, the leveed section of Bear Creek, the East Bear Creek pumping station, Taft Road pumping station, the Bear Creek structure (Shiawassee County) and the flood control portion of Sleepy Hollow. Channel improvements on Middlebury-Cravens Drain will be operated and maintained by the Shiawassee County Drain Commissioner. The Gratiot County Drain Commissioner will operate and maintain the channel improvements on Drain 142, Drain 38, and Bear Creek above the leveed section. The Michigan Department of Natural Resources will operate and maintain the recreation facilities of Sleepy Hollow and the recreation portion of the structure.

Operation and maintenance of the recreation facility at the Sleepy Hollow site will be accomplished by a full-time park manager and staff. All personnel will be trained in first aid techniques to handle minor emergencies. Ambulance service is available from Ovid to transport more serious cases to the hospital at Owosso.

The Sleepy Hollow public recreational development will be maintained and managed by the Michigan Department of Natural Resources as part of its State Park System. Admission will be on a fee basis; in addition, each campsite will be assessed a daily fee. Fees will be established by the Michigan Department of Natural Resources at the level which will amortize their initial investment and provide adequate operation and maintenance.

The following items will be provided for in the maintenance program:

1. A specific operation and maintenance agreement between the Soil Conservation Service and the appropriate sponsoring organization will be executed prior to signing a land rights or project agreement.

2. A joint inspection will be made annually or after unusually severe floods by representatives of the sponsoring organizations including those in the Drainage District having responsibility for the works of improvement to be installed. Representatives of the Soil Conservation Service will assist with these inspections. A record will be made of all inspections, with one copy for the sponsoring organization and one copy for the Soil Conservation Service.

3. After an initial three-year period of joint inspection, the inspections of the structural works of improvement will be made annually by the sponsors, and a copy of the report prepared by them will be sent to the Soil Conservation Service representative.

4. All costs for labor, equipment and materials for operation and maintenance will be furnished by the appropriate local sponsoring organization.

5. Maintenance rights-of-way to the structural measures will be furnished by local sponsoring organization.

6. Maintenance work on seeded areas by mowing or spraying with environmentally safe chemicals should be done after the nesting season, preferably after July 15.

Land treatment measures will be operated and maintained by individual landowners or farm operators. This will be accomplished under cooperative agreements with the Soil Conservation District. Technical assistance will be provided by the Soil Conservation Service, and for forestry measures, by the Michigan Department of Natural Resources.

PROJECT COSTS

Total project installation costs are $17,211,200. Of this total, PL-566 funds will pay $8,928,250 and other funds will provide $8,282,950.

Total construction costs for the project are $9,602,400. Construction costs distributed to PL-566 funds are $6,737,450 while other funds will pay $2,864,950.

ENVIRONMENTAL SETTING

PHYSICAL RESOURCES

The East Upper Maple River Watershed is located in Clinton, Gratiot, and Shiawassee Counties in the south central portion of the lower Peninsula of Michigan. The watershed includes 169,730 acres (265.2 square miles). Population of the watershed is approximately 20,000. This watershed is adjacent to the West Upper Maple River Watershed as shown on the Project Location Map. (See Appendix B.)

There are eleven towns and villages in the watershed. The three largest towns are Ovid (1,650 population), Elsie (1,000), and Ashley (550). Nearby towns include:

Lansing	- 20 miles southwest
Flint	- 20 miles east
Saginaw	- 30 miles northeast
Owosso	- 2 miles northwest
Ithaca	- 5 miles northwest
St. Johns	- 8 miles southwest

The East Maple River Watershed is part of the Grand River Basin which is the Lake Michigan Subregion of the Great Lakes Water Resource Region. It lies in the Southern Michigan Drift Plain Land Resource Area of the Lake States Fruit, Truck and Dairy Land Resource Region as shown in the "Atlas of River Basins of the United States."

Water resource problems of the area consist of flooding, impaired drainage, sedimentation, erosion and lack of adequate fish and wildlife development. Floods occur annually along the Upper Maple River and its tributaries during the heavy spring runoff in March and April. These floods are of such duration as to cause delayed planting and disruption of crop rotations throughout the flood plain. Floods also occur during the growing season nearly every year and damage growing crops. Over the past twenty years, floods have occurred an average of four times per year. Floodwaters also damage farm roads and surface drainage ditches, public roads and bridges, and farmstead residences.

Inadequate channel depth and capacity cause impaired drainage on an area of 23,500 acres, including 16,200 acres presently in cropland. The problem areas include the flood plain and adjacent lands which require internal and surface drainage for efficient agricultural use, and are dependent upon the Maple River and its tributaries for drainage outlets.

Sedimentation has occurred in all of the channels in the watershed. This has contributed to loss of capacity within the channels. Erosion damages within the watershed consist of movement of soil materials from cultivated land, roadside ditches, upland gullies, channels, and other sources. This creates local maintenance and cleanout expenses as well as damage to the land ecosystem itself. These damages and expenses result from local problems of erosion which occur throughout the watershed.

In general, the south central portion of the lower peninsula is characterized by significant rates of population growth according to "Michigan Projected Population," and a limited number of available recreation sites. The area has been historically deficient in recreation facilities. In the Tri-County Planning Region (Ingham, Eaton, and Clinton Counties), less than .45 acre of Federal, State and local recreation land is available per person. This is compared to a state-wide average of over .81 acres per capita. There are no major park or recreation facilities in the area despite the close proximity of several major population centers.

SOILS

Soils in the problem areas range from sand to clay in texture and from well drained to very poorly drained. Cropland is largely in Soil Conservation Service capability Classes II and III. (See Appendix E for definitions of capability classes.)

The Gratiot County part of the problem area is nearly level to gently sloping and has soils that are very poorly drained to somewhat poorly drained, and developed from silty clay loams, silty clays and clays. Included are the Toledo, Lenawee and Pert soils. Closely associated are local areas with 18 to 40 inches of loamy sand or sandy loam overlying the silty clay loams and clays. Included are the Selfridge and Pinconning soils. Also associated are areas of organic soil.

The organic soils include Adrian muck, which is a shallow muck over sand or loamy sand, and Houghton muck, a deep, well decomposed muck. The land is largely in capability Classes II and III.

The Clinton County part of the problem area is gently sloping and has soils that are poorly drained to well drained, and developed from loams. Included are the Capac, Parkhill, and Marlette soils. These soils are largely in capability Class II. Closely associated are soils developed in sandy loams, loamy sands and gravel. These are the Boyer, Wasepi, Matherton, and Spinks soils. These soils are in capability Classes III and IV. Also associated in the southern part of the problem area is Houghton muck.

The Shiawassee County part of the problem area is rolling to steep and has soils that are well drained to somewhat poorly drained, and developed in loams and clay loams. Included are the Miami, Conover, and Owosso soils. These soils are in capability Classes II and IV, with much of the land being Class III and IV due to steepness of slope and degree of erosion. Associated soils adjacent the Maple River are the Gilford, Tawas and Carlisle soils. These soils are poorly and very poorly drained.

Water-holding capacity of the soils in the watershed generally ranges from 7.0 to 8.5 inches. Soil infiltration rates are 1.0 to 4.0 inches per hour.

GEOLOGY

The problem area lies directly upon the lake bed of the ancient glacial Lake Saginaw. Valleys are oversized and the gradients are very low. Lake bed sediments are mainly silts and clays, with some sandy areas and beach deposits. To the west and south are the Owosso and Flint moraines, which are rolling to steep with mixed clay till and sandy outwash material. The glacial drift is approximately 100 feet thick. Beneath the glacial drift is the Grand River Formation of Pennsylvanian age. This formation consits mainly of sandstone and yields standard amounts of low quality ground water, high in dissolved salts.

"Water Resources of the Lower Lake Michigan Drainage Basin", (1968) indicates that throughout most of this area, wells in bedrock, which are 6 inches or more in diameter, will yield from 100 to 500 gallons per minute (gpm). In some locations, wells may yield less than 100 gpm or more than 500 gpm. Wells in fine grained glacial deposits will generally yield less than 10 gpm. An adequate supply of ground water is available for domestic and agricultural needs. Depths to ground water in the flood plains range from 0.5 - 10.0 feet, while depths range from 18.5 - 19.5 feet on upland adjacent to the flood plain. (Dames and Moore, 1973.)

Topography of the watershed is moderately rolling throughout, except an area on the north side of the Maple River in Gratiot County, which is level to gently sloping. Elevations vary between 870 feet above sea level near the upper end to 655 feet above sea level at the confluence of Bear Creek (Gratiot County) with the Maple River.

Sand and gravel are the only known mineral resources of economic value within the watershed. Sand and gravel pits are currently being operated at one location in the Clinton County part of the watershed and at four locations in the Shiawassee County portion.

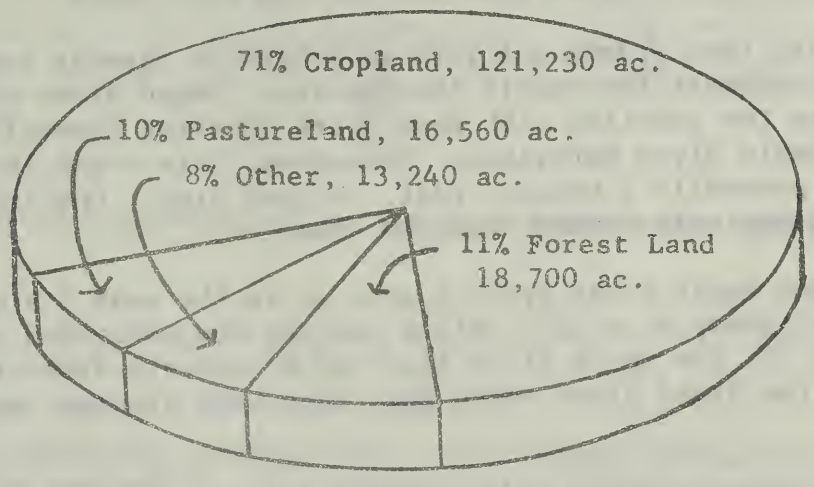
There are no U. S. Weather Bureau Stations in the watershed. The nearest climatological station is located at St. Johns, about 8 miles southwest of the watershed. The length of record for this station is 33 years. Pertinent climatic data on this station from "Climate of Michigan by Stations" (1971) are shown in Table 3.

LAND USE

Present land use in the watershed is mainly agricultural with approximately 71 percent of the watershed in cropland. (See Figure 14.) Approximately 11 percent (18,700 acres) of the total land area is in forest cover. Pasture land covers 10 percent and other land (farmsteads, road, water and wildife) 8 percent of the watershed. Eighty percent of the forest is in either good or very good hydrologic condition. Land use within the major problem area is 67 percent cropland, 12 percent pasture, 9 percent forest, and 12 percent in other uses.

TABLE 3 - Climatic Data

January average temperature	22.8oF
July average temperature	71.2oF
Maximum temperature recorded	102oF
Minimum temperature recorded	-19oF
First killing frost in fall (ave.)	Sept. 29
Last killing frost in spring (ave.)	May 12.
Length of growing season	140 days
Average annual precipitation	30.2 inches
Maximum annual precipitation (1950)	41.5 inches
Minimum annual precipitation (1958)	20.03 inches
Maximum 24-hour precipitation (Aug. 1952)	3.78 inches
Percentage of average annual total precipitation received during April through September	62 percent



Total Acreage....169,730

FIGURE 14 - LAND USE IN THE WATERSHED

The Michigan Department of Natural Resources manages 1,900 acres of State-owned game lands in the northwestern part of the watershed. This is part of the Gratiot-Saginaw State Game Area which includes an extensive area east of the watershed boundary. (See Project Map in Appendix B.)

WATER RESOURCES

The Maple River is the major stream in the watershed. It originates just south of the town of Corunna in Shiawassee County. Flow for several miles is westerly through a one-half mile wide flat valley of cropland, woods, and marshes. Near Owosso the channel is about 10 feet wide. The river flows northwesterly through the town of Ovid to the village of DuPlain through active cropland. It increases to 40 foot width and remains at that width through the rest of the East Upper Maple River Watershed. Bear Creek (Shiawassee County), Alder Creek, and Little Maple River are major tributaries which join the main stem in this reach. Downstream of this point, the river becomes somewhat entrenched and meanders northward for about 10 miles to Bannister. Baker Creek enters the river from the east in this reach.

The valley then widens out into an extensive farming area as the river flows northwest for nearly three miles. Maple River runs westerly two miles into the junction with Bear Creek (Gratiot County) and the end of the East Maple River Watershed. Throughout this reach the land near the river is generally a wooded, flat, wetland area. Outside of this area is an intensively farmed cropland area.

West Upper Maple River project area is in the next 3.8 miles of the river to Highway U. S. 27. After leaving the watershed area, at U. S. Highway 27, the Maple River flows in a westerly direction and discharges into the Grand River which goes into Lake Michigan near Grand Haven.

Natural channels were largely modified in the early twentieth century. Nearly all of the Maple River within the East Upper Maple River Watershed and most of the tributaries were altered at that time. The tributaries of the river are indicated in Figure 15. Table 4 lists the length, type of channel and flow condition of each tributary.

FIGURE 15 - TRIBUTARIES OF THE EAST UPPER MAPLE RIVER

"Michigan Lakes and Ponds" (1965) lists nearly 450 acres of lakes and ponds in the watershed. The Sleepy Hollow recreation reservoir will add 412 acres of water surface. Ten other lakes make up 350 acres of the total with Lake Victoria (160 acres), and Mantoon Lake (80.0) the largest. The remainder of the water surface is in numerous small ponds.

TABLE 4-TRIBUTARIES TO EAST UPPER MAPLE RIVER

NAME	MILES OF CHANNEL	TYPE OF CHANNEL (1)	FLOW CONDITION (2)
TRIBUTARY A	1.5	0.5M	PER
		1.0N	PER
	3.0	N	INT
REYNOLDS DRAIN	3.0	3.0M	PER
TRIBUTARY B	2.0	N	INT
TRIBUTARY C	5.5	N	PER
	0.5	N	INT
SPRING BROOK	3.5	N	PER
	3.0	N	INT
DRURY DRAIN	3.0	M	PER
	3.0	N	INT
WILSON DRAIN	3.0	M	INT
TRIBUTARY D	3.2	N	INT
TRIBUTARY Da	1.5	0.8M	INT
		0.7N	INT
TRIBUTARY E	4.8	N	INT
BEAR CREEK	8.4	N	PER
	11.6	N	INT
TRIBUTARY F	5.2	N	INT
COON CREEK	2.8	M	PER
	4.2	N	INT
	2.2	M	PER
	1.2	M	INT
MIDDLEBURY CAVENS	3.0	M	PER
	2.0	M	INT
TRIBUTARY G	1.8	N	INT
ALDER CREEK	10.0	M	PER
	3.0	M	INT
HICKOK DRAIN	3.6	2.7M	PER
		0.9N	PER
LITTLE MAPLE RIVER	16.5	M	PER
JURY DRAIN	1.8	M	PER
	1.4	M	INT
TRIBUTARY H	2.0	N	PER
CUTLER & WALKER DRAIN	3.8	M	PER
	2.6	N	INT
TRIBUTARY I	1.4	N	INT
TRIBUTARY J	2.2	M	INT
DUPLAIN AND OVID DRAIN	6.5	M	INT
STURGIS DRAIN	4.5	M	INT
STEVENS DRAIN	3.5	M	INT
TRIBUTARY K	2.0	M	INT
BAKER CREEK	8.0	2.0M	PER
		6.0N	PER
	8.0	2.0M	INT
		6.0N	INT
WAIT DRAIN	15.0	7.5M	INT
		7.5N	INT
WISE CREEK	1.5	N	PER
	1.0	N	INT
TRIBUTARY M	2.5	N	PER
	6.5	.50N	INT
		.50M	INT
		3.2N	INT
		3.3M	INT
TRIBUTARY N	2.5	.50N	INT
		.50M	INT
		3.2N	INT
		3.3M	INT
TRIBUTARY O	3.5	M	INT
TRIBUTARY P	0.5	3.0M	INT
	4.0	1.0N	INT
NEWTON AND STURGIS DRAIN	2.5	M	PER
	4.0	M	INT
DRAIN 142	11.5	M	INT
	0.8	M	PER
DRAIN 38	10.0	M	INT
BEAR CREEK	11.9	8.4M	PER
		3.5N	PER
	3.3	M	INT
TRIBUTARY Q	2.2	M	INT
TRIBUTARY R	16.5	M	INT

1/ M-Man-made ditches or previously modified channel.
N-Natural stream course

2/ PER-Perennial, flows at all times except during extreme drought.
INT-Intermittent, flows through some seasons of the year but little or no flows through other seasons.

Based on the discharge data at Maple Rapids (20 miles downstream) the typical discharge pattern is shown on Figure 16. The extremes during the 29 years of record are 6,500 cubic feet per second on March 20, 1948 and 4.4 cubic feet per second on August 13, 1965.

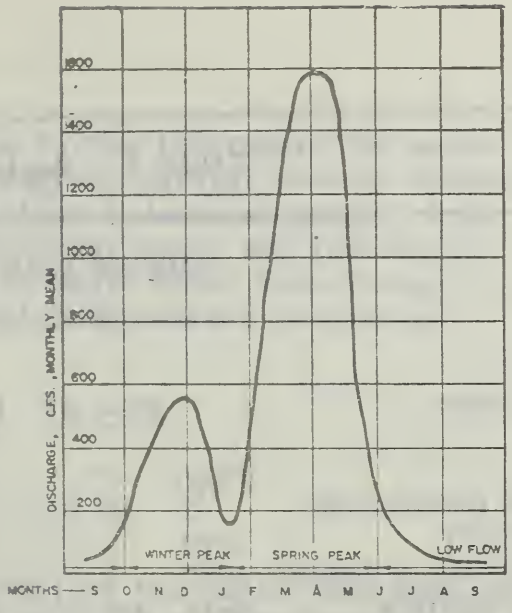


FIGURE 16

TYPICAL DISCHARGE PATTERN
MAPLE RIVER AT MAPLE RAPIDS

Uses for the Maple River established by the Michigan Water Resources Commission, "Water Quality Standards" (1973) are: (a) warm-water fish including bass, pike, walleye, and panfish, (b) partial body contact recreation, (c) public water supply at the point of water intake, (d) agriculture, (e) navigation, and (f) industrial water supply. Dames and Moore investigations determined that the river bottom substrate consists of medium to stiff to very still brown, sandy to clayey silts (ML) and silty clays (CL) overlain by silty sand, occasional boulders and accumulated detritus.

WATER QUALITY

Physical and chemical data on the river water are available from two sampling stations through DNR Background Water Quality storet retrieval. One station is located near Ovid at Warren Road bridge, the other below West Upper Maple Watershed at M-21 bridge in Ionia County. Only general conclusions can be drawn from the six available samples as the sample stations are about 50 miles apart and sample dates cover a timespan from 1967 to 1973. However, these data shown in Table 5 provide general information on the water quality to reflect present quality conditions.

TABLE 5 - Maple River Water Quality

		SAMPLES NEAR OVID		SAMPLES 25 MILES DOWNSTREAM FROM WATERSHED			
Date:		10-4-67	10-14-70	8-30-71	4-17-71	5-15-73	6-7-73
FLOW	ft3/s	7	3	39	*3,000	*2,000	*3,000
WATER TEMPERATURE	°C	20.0	14.0	17.5	7.5	10.0	18.0
TURBIDITY	JTU	--	6.0	17.0	7.0	5.0	43.0
CONDUCTIVITY umhos	25°C	--	700	570	540	540	520
TOTAL RESIDUE	mg/1	499	464	413	358	359	411
pH		8.0	8.1	8.1	7.9	7.8	7.5
DO	mg/1	10.8	7.2	6.8	10.3	8.3	--
BOD5-Day	mg/1	1.4	--	1.3	2.8	1.2	--
ORG N	mg/1	--	--	0.06	0.31	1.30	0.90
TOTAL NO3 N	mg/1	0.45	0.30	0.40	1.20	0.98	1.20
TOTAL NH3 N	mg/1	0.00	0.05	0.06	0.01	0.01	0.08
TOTAL	CaCO3mg/1	300	295	210	195	210	205
TOTAL HARD	CaCO3mg/1	385	390	280	275	295	250
TOTAL PHOSPHATE	mg/1	0.05	0.04	0.13	0.12	0.17	0.21
CHLORIDE	mg/1	8	15	37	24	24	23
FECAL COLI	MPN/100ml	300	--	130	10	30	470

*Flows are estimates based on discharge data at Maple Rapids Station.

The foregoing table of sample data shows low to moderate turbidity. The relationship between conductivity and total residue follows the expected range (66% - 79%) for that geographic area and the total residue falls just below the tolerable maximum from Pettyjohn of 50 mg/1. The dissolved oxygen (DO) ranges from 70 percent to saturation and the 5-day BOD remained below 3 mg/1. Nitrogen (N) levels as nitrites, nitrates, and ammonium are below the undesirable levels. Chloride and phosphate levels show little evidence of pollution from adjacent soil runoffs. Hardness, measured in mg/1 of calcium carbonate, is about twice the amount defined as "very hard" by Pettyjohn. The alkalinity of the water is also reflected in the pH value of 8. It must be stated that the above data are based on six samples only, and that the analysis, therefore, reflects only general characteristics of the river water, which may vary drastically during one climate cycle.

According to the selected parameters in the literature the water quality is acceptable for wildlife, recreation, partial contact sports, agriculture, and with treatment for municipal industrial usage. Presently the water is being used for agricultural needs and indirectly through wells for domestic supply. Little Maple River from Sleepy Hollow Dam upstream is protected for total body contact recreation.

PLANT AND ANIMAL RESOURCES

Approximately 11 percent (18,700 acres) of the total land area is forest cover and is generally considered to be in good hydrologic condition with a potential for hydrologic improvement. Most of the forest land is privately owned and scattered throughout the watershed in small tracts averaging 10 to 15 acres in size and is predominantly hardwood stands with some scattered pine plantations. The two major timber types are northern hardwood and oak-hickory. Maple, oak, hickory, basswood, and ash are the major species present. Some walnut, cherry hawthorn, and beech can be found. The Dutch elm disease has killed a large number of elm trees throughout the watershed. Many of these trees have fallen into the river causing blockages.

Forest fire protection is provided by the Michigan Department of Natural Resources in cooperation with the U. S. Forest Service through the Clarke-McNary Cooperative Forest Fire Control Program.

In addition to the above mentioned trees many shrubs, grasses, legumes, weeds, and vines occur in the watershed. The more common ones are shown in Table 6. There are no known rare or endangered plant species in the watershed.

The Maple River from Elsie downstream is classified by the DNR Stream Classification Maps as "top quality, warmwater mainstream," (a stream containing good populations of warmwater game fish and large enough to permit fishing with all standard gear). The remainder of the Maple River and all tributaries are classified as second quality warmwater fishery.

TABLE 6 - Plants Found in the Watershed

Weeds	Shrubs	Grasses
Chicory	Choiceberry	Bluegrass
Daisy Fleabane	Dewberry	Bromegrass
Goldenrod	Elderberry	Quackgrass
Lambsquarter	Gray Dogwood	Reed Canarygrass
Milkweed	Hawthorn	Timothy
Mullen	Juniper	
Orange Hawkweed	Pin Cherry	
Pigweed	Red-osier Dogwood	Legumes
Ragweed	Rubus Species	
Smartweed	Shrub Willow	Alfalfa
Thistle Species	Silky Dogwood	Red Clover
Wild Carrot	Sumac Species	Sweet Clover (white & yellow)
Vines		White Dutch Clover
Bitter Nightshade		
Greenbriar		
Poison Ivy		
Wild Grape		

Fish inventory taken on the Maple River in 1974 indicate small to moderate numbers of northern pike, black crappie, large-mouth bass and green sunfish upstream of Elsie. Few game species were found in the river from Hollister Road near Ovid upstream to the headwaters (Table 7). Better fish numbers occurred at Shepardsville, DuPlain, and Elsie, an area that might be considered transitional. It should be noted that no channel alterations are contemplated from one mile below DuPlain to Bannister. Below Elsie good warmwater game fish numbers exist, and they strengthen steadily toward the lower boundary of the area. Catfish become an important part of the area below Bannister, and a good small-mouth bass population exists between Elsie and Bannister. Even better fish counts were recorded below the Maple River project area downstream of US-27 where no channel alteration is planned. Forage fish that have been observed include minnows, chubs, shivers, and darters.

TABLE 7 - Fish Survey Data--Maple River

Station	Game and Panfish Number	Game and Panfish Weight (lbs.)	Non-Game Fish Number	Non-Game Fish Weight (lbs.)
1973 Fish Kill				
Shepardsville Rd. (Nr. Mead)	10	--	135	--
Harmon Rd. (Nr. St. Clair)	21	--	166	--
Harmon Rd. (Nr. Watson)	21	--	193	--
Shepardsville Rd. (Nr. Walker)	15	--	163	--
1974 Fish Survey				
Ransom Road	46	24	29	26
Gratiot Road	41	14	100	74
Upton Road	115	39	193	121
Mead Road	95	16	88	64
St. Clair Road	8	1	0	0
Watson Road	45	11	60	71
Shepardsville Road	133	61	236	156
Hollister Road	19	7	25	24
Warren Road	5	3	14	5
Baldwin Road	19	9	11	3
M-47	4	--	5	1

A fish kill near Ovid in 1973 may have effected the fish population obtained in the 1974 survey between Ovid and Elsie. Moderate numbers of game fish near Shepardsville would indicate that the effect is limited in extent.

Dominant invertebrates observed are scuds (Amphipodae), water boatmen (Corixidae), in addition to numerous nymphs of the orders Ephemerida and Odonata. The observed macroorganisms are bottom dwellers found usually under lenitic (stillwater) conditions. They include sowbugs (order Amphibota), snails (family Gastropoda), clams (family Sphaeriidae), giant cranefly larvae (order Diptera), mayflies (order Ephemerida), damsel flies (order Odonata), and some genera of Chironomus and Tubifex. Some of these species are tolerant to pollution and

and low oxygen levels and thus may be used with some discretion as indicators for pollution. The odor and the presence of some of the pollution tolerant benthos (bottom dwelling organisms) indicate an oxygen deficient, reducing condition suggestive of pollution.

Wetlands in the flood plain provide excellent habitat for amphibians, waterfowl, and semi-aquatic birds. There are eight (8) acres of Type 1 and seven (7) acres of Type 5 wetlands as defined in Department of the Interior, Circular 39 entitled "Wetlands of the United States" in the flood plains of this watershed. Slightly over 200 acres of Type 6 (brush swamp) wetland and 379 acres of Type 7 (wooded swamp) are also located in the flood plain.

The watershed is located on the major waterfowl flyway between Wisconsin and Lake Erie (Appendix 17, Wildlife Great Lakes Basin Commission). The wetlands are ideal for migrating teal, mallards, and black ducks. Nesting areas are available for black ducks, mallards, blue-winged teal, and wood ducks.

The 250 miles of tributaries and drains also provide habitat for semi-aquatic birds and mammals. Other species such as pheasants, doves crows, songbirds, hawks, cottontail rabbits, fox and gray squirrels, skunks, opossums, raccoons, red fox and white-tailed deer have habitats available among the interspersion of 18,700 acres of forests, 137,790 acres of cropland and pasture land. There are few brushy fencerows. Swans use the Michigan Department of Natural Resources marsh and adjacent areas as a resting place during the spring and fall migration.

Wildlife game species in the watershed as noted by Benson are shown in Table 8. The Greater Sandhill Crane, a rare species, is known to have nexting grounds immediately south of this watershed. It is not known if it extends into the watershed. No other rare endangered species of mammals, birds, amphibians, reptiles or fish are known to exist in the watershed.

TABLE 8 - GAME SPECIES
IN THE EAST UPPER MAPLE RIVER WATERSHED

Species	Relative Abundance	Management Potential	Game Range Zones
Cottontail Rabbits	Moderate (0-33/100 acres)	Good - rabbits can be encouraged by providing areas of thick, brushy cover.	Thick, brushy cover
Tree Squirrels	Moderate (1/25 acres)	Good - squirrel populations occur in many woodlots and the population is generally under harvested.	Forested areas with oaks
White-tailed Deer	Low - moderate (5-30/sq. mi.)	Medium - huntable populations occur throughout watershed. Highest numbers found in the Maple River Flood Plain. Because conflicts with agriculture and increasing car-deer collisions, it may be necessary to control further increases of deer population.	Any forested areas
Ring-necked Pheasants	Moderate (20-40 hens/sq.mi.) (5-15 roosters/sq. mi.)	Good - the watershed constitutes fair to good pheasant range and the population will increase in the future.	Throughout the watershed
Quail	Low	Limited - Clinton County was opened to Quail hunting in 1966. Because the county is on the northern fringe of the quail's range, the population will fluctuate, depending on the severity of the winter.	Clinton County
Ruffed Grouse	Low, species cyclic.	Limited.	Maple River State Game Area
Waterfowl		Limited - the Maple River State Game Area provides the best waterfowl hunting in the watershed. During the spring migration many of the waterfowl species found in Central North America can be observed on the Maple River and this attracts considerable interest. Natural lakes and marshes attractive to waterfowl are not found throughout the remainder of the watershed.	Maple River and adjacent land
Wood Duck	High (8-12 nesting pairs/ mile of river)		
Blue-winged Teal	High		
Mallard	High		
Black duck	Low		
Woodcock	Moderate, mostly flight woodcocks	Limited.	Maple River and adjacent lowland swales
Turkey	Low	Limited - planted in State Game Area in 1966.	Maple River State Game Area
Snowshoe Hare	Very low.	Have been planted in the State Game Area	Maple River State Game Area
Muskrats	High (8/acre of wetland)	Excellent.	Maple River State Game Area

PRESENT AND PROJECTED POPULATION

Present population in the watershed is estimated about 20,000. It is largely rural, farm oriented in character. Many residents, however, commute to nearby cities for employment. Population is projected to increase to 23,400 by 1990 and 25,400 by 2020. An estimated seven percent of families have incomes below the poverty level. All minority groups constitute less than two percent of the population.

ECONOMIC RESOURCES

Of the 20,000 population, 3,200 persons live within the village limits of Ovid, Elsie, and Ashley. The remaining 16,800 persons are listed as rural residents. Michigan Statistical Abstract indicates recent increases in rural residents, particularly in Shiawassee (30 percent) and Clinton (29 percent) Counties which reflect the major thrust of population growth in the region.

Census of Agriculture 1969 indicates a large proportion of this rural population are non-farm residents as illustrated by decreasing total cropland and relatively stable average farm size. This indicates a substantial increase in rural non-farm housing which is expected to continue into the foreseeable future.

Major land use in the watershed continues to be agriculture. The entire watershed is privately owned with the exception of 1,900 acres managed by the Michigan DNR as a portion of the Gratiot-Saginaw State Game Area.

Dairy and cash cropping are the major farming enterprises in the watershed. There were 1,353 farms reported in the watershed in 1969 which averaged about 125 acres. Eighty-one percent of the watershed (137,790 acres) is reported in cropland and pasture. Major crops produced are corn, soybeans, and wheat. Other crops grown in the area include sugar beets and edible dry beans. Yields for the principal crops grown are illustrated in Figure 17 showing adequately drained and not drained conditions.

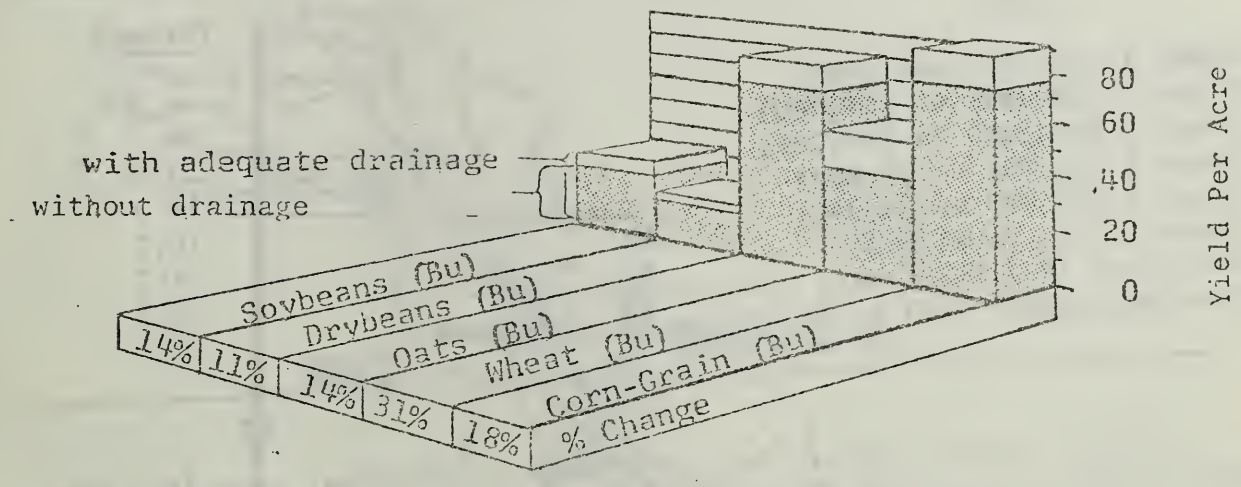


FIGURE 17 - Current Crop Yields

Census of Agriculture shows that over 85 percent of the farms in the watershed are individual or family farms. The percentage of total farms in each economic class is shown on Table 9. These figures are determined by the market values of all farm products sold.

Average market value per farm (1969) of all agricultural products sold was $10,253 (computed average for Clinton, Gratiot and Shiawassee Counties) and $10,641 for Michigan. In 1969, 7.6 percent of all farm operators in these three counties worked off the farm 100 to 199 days. An additional 47.1 percent worked off the farm more than 200 days. This is close to the state average. In Michigan as a whole 7.8 percent of all farmers worked 100-199 days off farm with an additional 44.1 percent working 200 days or more off the farm.

TABLE 9 - Percent Farms by Economic Class

Class	Percent
Class I ($40,000 and over)	4.7
Class 2 ($20,000 to $39,000)	9.7
Class 3 ($10,000 to $19,000)	13.0
Class 4 ($5,000 to $9,999)	15.0
Class 5 ($2,000 to $4,999)	16.7
Class 6 ($50 to $2,499)	4.3
Part-Time ($50 to $2,499; operator under 65)	29.3
Part-Retirement ($50 to $2,499; operator over 65)	6.7

Upland used for agricultural purposes is valued at over $600 per acre. Flood plain land which is being farmed is valued at $400 per acre while land adjacent to the river is valued at $300 per acre. Land values are subject to significant fluctuation due to the proximity to water, attractiveness as speculative property or the amount of drainage measures which have been installed.

The area is served by a good network of county and township roads. U. S. Highway 27 is the main north-south highway, crossing the watershed near its western boundary. Michigan Highway 57 is the major east-west highway. (See Figure 18.)

Four railroad lines cross the watershed and provide transportation for agricultural products and supplies. The Ann Arbor Railroad passes through Ashley, Bannister, and Elsie in the northeastern end. Two Grand Trunk Western Railroad lines also serve the area; the one passing through Ovid is a major east-west track line for the company; a shorter section enters Ashley with connections to the Ann Arbor line and will serve the area's sugar beet receiving station in the west part of the watershed.

Social and economic data for the upper Maple River watershed by [illegible] Michigan Statistical Abstracts and other sources, reflect is wholly included within the boundaries of Clinton, Gratiot, and Shiawassee Counties.

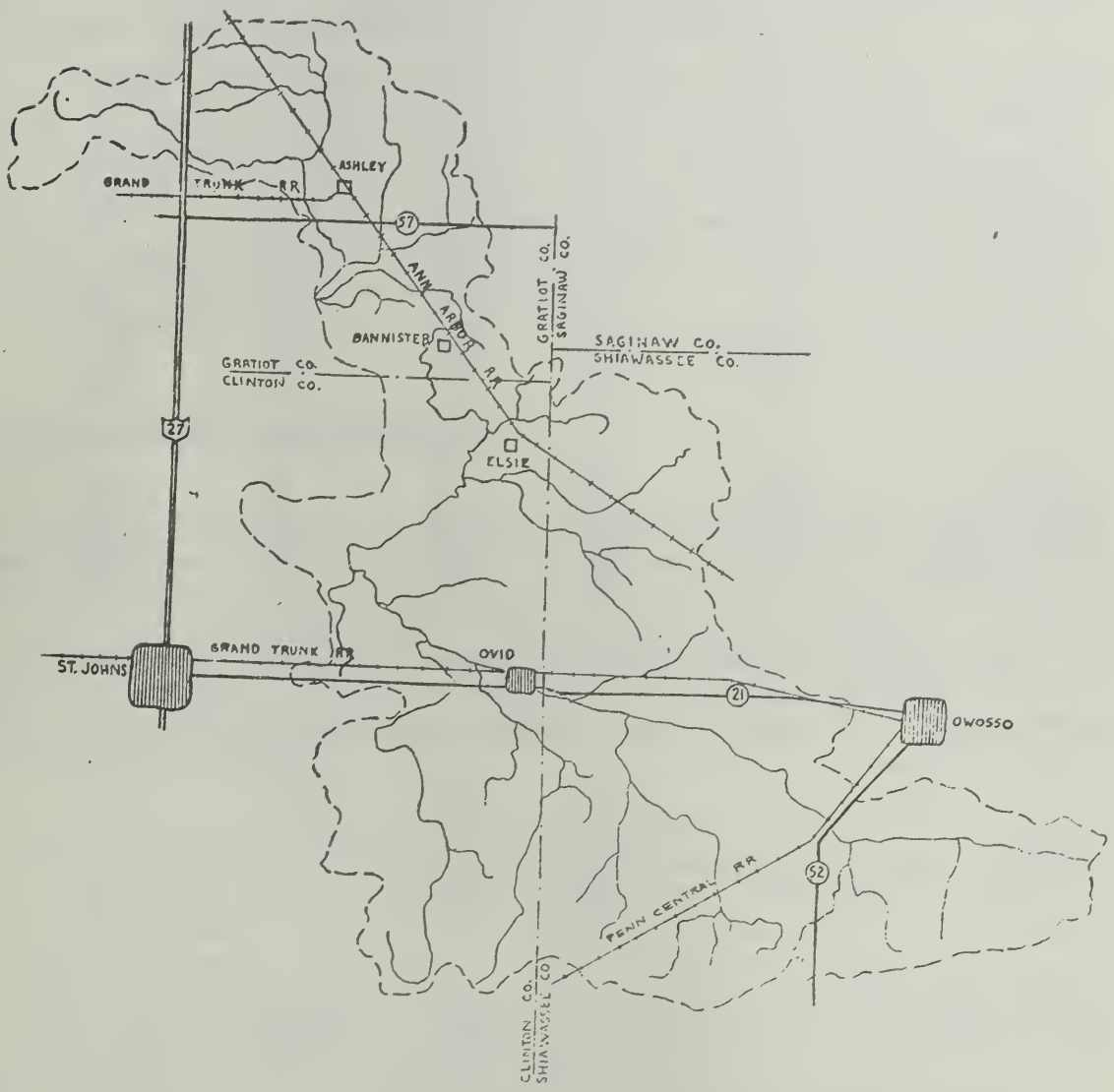


FIGURE 18 - TRANSPORTATION NETWORK

TABLE 10 - SOCIAL CHARACTERISTICS a/

Factor	UNIT	Gratiot Co.	Clinton Co.	Shiawassee Co.	Michigan
Population					
1960	No.	37,012	37,969	53,446	7,823,194
1970	No.	39,246	48,492	63,075	8,879,862
Change 1960 to 1970	%	6.0	27.7	18.0	13.5
Rural 1960	No.	21,615	29,681	30,364	2,084,062
Rural 1970	No.	22,606	38,154	39,389	2,321,310
Rural change 1960 to 1970	%	4.6	28.5	29.7	11.4
Urban 1960	No.	15,397	8,288	23,082	5,739,132
Urban 1970	No.	16,640	10,338	23,686	6,553,753
Urban change 1960 to 1970	%	8.1	24.7	2.6	14.2
1990 b/	No.	43,221	73,151	86,731	12,226,000 c/
Change 1970 to 1990	%	10.1	50.9	37.5	37.7 d/
Density 1970	No./sq.mi.	69.3	84.8	116.8	156.2
Net migration 1960 to 1970	No.	-2,804	4,160	1,511	27,236
Persons per household e/	No.	3.32	3.55	3.38	3.27
Health					
Physicians f/	No.	40	13	39	11,214
Dentists f/	No.	11	11	21	4,518
Nurses f/	No.	314	253	441	68,713
Hospitals g/	No.	1	1	1	248
Hospital Beds g/	No.	142	83	276	40,587
Nursing Homes g/	No.	7	5	2	458
Nursing Home Beds g/	No.	486	117	206	37,671
Housing					
Total Occupied Units e/	No.	11,332	13,605	18,581	2,653
Education					
Enrollment e/	No.	12,424	15,912	19,429	2,770,179
Persons 25 & Older completing high school					
Male	%	51.7	50.2	50.4	51.2
Female	%	56.3	69.2	55.7	54.2
Employment					
Nonworker-worker ratio e/	Ratio	1.63	1.58	1.57	1.52
Unemployment g/	%	15.0	5.9	17.2	8.2
Income					
Per capital personnel income (1969) h/	$	3,117	--	3,152	--
Medium family income h/	$	8,891	11,014	10,540	--
$15,000 and over h/	%	15.9	23.0	20.5	--
Below poverty level h/	%	9.0	5.2	7.0	--

a/ From Michigan Statistical Abstract except as noted.
b/ Project 80 and 5, "Summary of Phase 1 Papers," Michigan State University, 1972.
c/ Project 80 and 5, projection for year 2000.
d/ Percent change from 1970 to 2000.
e/ 1970 information.
f/ 1972 information.
g/ 1971 information.
h/ 1969 information.

Agriculture is the major industry in the watershed. In addition, employment opportunities are found in retail, wholesale and other industries in the nearby market and supply centers of Alma, St. Johns, and Owosso. Industrial manufacturing is prevalent on a larger scale in the regional industrial communities of Lansing and Flint.

The sugar beet receiving station located near the watershed at the junction of US-27 and M-57 is operated by the Michigan Sugar Company. This station receives sugar beets for rail and truck shipment to processing plants near Saginaw, Michigan. Previously high transport costs incurred by local beet producers discouraged sugar beet cultivation in the area. The receiving station contributes to a more diversified use of existing cropland in the watershed.

RECREATIONAL RESOURCES

Existing recreational resources in the watershed are fall colors, snowmobile areas, river canoeing, and the multiple use of 1,900 acres of the Gratiot-Saginaw State Game Area. An additional 12,000 acres of State Game Areas are available within ten miles of the watershed. Major recreational uses of State Game areas from Michigan Recreation Plan are as follows, in declining order of occurrence: hunting, fishing, berry picking, picnicking, swimming, camping, sightseeing, mushrooming, boating and target shooting.

Greatest utilization of wildlife resources appear to be the hunting of waterfowl, fox and gray squirrels, pheasants, cottontail rabbits, and deer. An estimated 17,500 annual hunting trips are spent in the watershed. The aesthetic value of the wildlife in the river and marshes is appreciated by many individuals, nature clubs, and school groups. Recreational potentials for Gratiot, Clinton, and Shiawassee Counties from the "Appraisals of Potential for Outdoor Recreational Development" are shown in Table 11. Sport fishing survey made in 1970 indicates approximately 4,000 angler days per year are spent in the watershed.

TABLE 11 - Potentials for Outdoor Recreation

Activity	GRATIOT COUNTY Potential	SHIAWASSEE COUNTY Potential	CLINTON COUNTY Potential
Vacation Cabins, Cottages, and Homesites	High	Medium	Medium
Vacation Site Camping Grounds	Medium	Low	Medium
Canoe Trips	Medium	Medium	Low
Transient Campgrounds	Medium	Low	Medium
Game, Play & Target Areas	High	High	High
Bicycling	High	Med.-High	High
Picnic Areas	High	High	Medium
Fishing Waters-Warm	Medium	Medium	Medium
Standard & Par 3 Golfing	High	High	High
Driving Ranges & Miniature Golfing	High	High	High
Hunting-Small Game	High	Medium	High
Hunting-Big Game	Medium	Medium	Medium
Hunting-Waterfowl	Medium	Low	Medium
Natural Areas	Medium	Medium	Medium
Scenic Areas	Medium	Medium	Medium
Historic Areas	Med.Low	Medium	Med.Low
Riding Stables	Medium	Medium	High
Shooting Preserves	Medium	Medium	High
Vacation Farms	Medium	Medium	Medium
Water Sports	Medium	Medium	Medium
Winter Sports	Low	Low	Low

Public access is available to the Gratiot-Saginaw State Game Area, however, no recreation facilities are provided. Access to other areas in the watershed is obtained by permission from private landowners. Increasing numbers of farmers are posting their land against trespass and hunting.

Present water quality does not have a known effect on the use of recreational resources. Water based recreational activities are of the nature and level of participation that would be expected from the type of water resources found in the watershed.

ARCHEOLOGICAL, HISTORICAL, AND UNIQUE SCENIC RESOURCES

A literature search by Joseph L. Chartkoff has revealed thirty-seven archeological sites have been reported in the East Upper Maple River Watershed. Three locations are dated "late archaic" (3000 to 1000 B.C.) including two camp sites. Twenty-seven sites are mounds of the "Woodland" Age, 1000 B.C. to 1600 A.D. Late Woodland Period (400 to 1600 A.D.) sites include two ethnographic villages, one temporary camp and a cemetary. A cache of the "Woodland" Period has recovered 400 points, celts and axes. Other artifacts reported are: copper gouge, copper axe, conch shells, spear points, slate gorgets, grooved axes and effigy carvings.

The National Register of Historic Places include the Main Street building of the United Church of Ovid, Ovid. No other property is known to exist which would be eligible for inclusion in the National or State Registers of Historic Places.

SOIL, WATER, AND PLANT MANAGEMENT STATUS

Because of flooding and impaired drainage, it is often not possible to follow recommended crop rotations and cultural practices in the problem areas. Per acre yields are lower in the problem areas than in the watershed as a whole by 12 bushels for corn grain, 14 bushels for wheat, 10 bushels for oats, 3 bushels for dry edible beans, 8 bushels for soybeans, and 1.3 tons for hay.

The Soil Conservation Districts conduct information programs on the benefits of proper land treatment. They encourage landowners and operators to maintain land treatment measures for the protection and improvement of the watershed. Of the 1,119 farms in the watershed, 604 or about

54 percent are cooperators with the Soil Conservation Districts. There are 508 basic conservation plans which have been prepared and approximately 25 percent of planned practices have been applied. Within the problem area, nearly all of the farm operators are now cooperators and are applying needed conservation measures. Forty-five percent (76,000 acres) of the land in the watershed is presently adequately protected. Table 12 shows the land treatment practices applied as of July 1974. About 10 percent of the forest is adequately treated for optimum production, however, there is adequate fire control and little sediment is produced.

PROJECTS OF OTHER AGENCIES

There are no planned or on-going projects in this watershed which will be adversely influenced or affected by this project.

TABLE 12 - Land Treatment Measures Applied

Land Treatment Measures	Unit	Applied as of July 1974
Conservation Cropping System	Acres	43,431
Crop Residue Use	Acres	41,839
Farm Ponds	No.	58
Grade Stabilization	No.	52
Grassed Waterway	Acres	28
Land Smoothing	Acres	8,888
Minimum Tillage	Acres	36,551
Drainage Main or Lateral	Feet	146,210
Drainage Field Ditch	Feet	24,000
Tile Drain	Feet	9,530,482
Pasture & Hayland Management	Acres	2,058
Pasture & Hayland Planting	Acres	998
Hedgerow Planting	Feet	48,250
Wildlife Wetland Management	Acres	667
Wildlife Habitat Management	Acres	6,316
Field Windbreaks	Lin. Feet	107,700
Recreation Access Road	Feet	5,940
Recr. Land Grading & Shaping	Acres	192
Recr. Trail and Walkway	Feet	8,400
Tree Planting	Acres	610
Hydrologic Cultural Operations	Acres	488
Woodland Grazing Control (4 mile)	Acres	200

WATER AND RELATED LAND RESOURCES PROBLEMS

LAND AND WATER MANAGEMENT

Improved management practices, such as commercial fertilizer use and minimum tillage are not being implemented to the fullest extent on lands with inadequate drainage. Agricultural lands do not produce yields up to the soil potential without full management. Inadequate drainage and flooding make it impractical to follow recommended crop rotations and also has prevented many land managers from making necessary investments in land treatment measures. Few farmers are using adequate amounts of fertilizer due to high potential losses in the flood plain. Management plans and timber stand improvement measures are lacking on forest lands, and thus, do not produce up to their potential.

Spring and fall floods and impaired drainage also prohibit performing field operations in a timely manner, causing decreased yield and inefficient use of land, labor, and capital. As a result, agricultural land is often put to a less intensive use than its potential capabilities. Susceptible small grain and navy bean crops have been replaced with soybeans which are more tolerant to excess water and late planting. More farmers are fall plowing in order to speed up field operations after the spring floodwaters recede. This can increase sheet erosion rate by three-fold (10 tons per acre per year) on the cropland of the problem area. (See Technical Guide, 1963.) The necessary capital for installation of land treatment measures would be available if adequate protection was insured.

FLOODWATER DAMAGE

Floodwater damage is a major land and water resource problem of the watershed. Villages of Bannister and Ovid are partially within the flood plain area and have received some damage, but most of the damages are primarily to agricultural lands. The annual flood hazard has adversely affected land use and crop rotations in the 13,600 acre flood plain.

Some areas of former cropland have reverted to pasture or brush because of an increase in the frequency of flooding since 1955. Corn and soybeans are presently being grown on highly productive soils normally suitable for such water-sensitive crops as navy beans and sugar beets. In addition to crop and pasture damage, floodwater damages farm roads, surface drainage channels, 7 miles country roads, 11 bridges, and 16 farmstead residences.

Floods of greater magnitude (over 10 year frequency) spill water across the watershed boundary into the Shiawassee River Basin. This prevents a large additional acreage from being flooded by these storms.

The farms in the area average 125 acres in size. Land use in the flood plain including major crops, is shown in Table 13. Cropland makes up 67 percent of the present land use with soybeans being the major crop with a total of 23 percent. Woods are the major use in the remaining 48 percent of non-cropland.

Floods occur annually along the Upper Maple River and its tributaries during the heavy spring runoff in March and April. These floods are of such duration as to cause delayed planting and prevent proper distribution of crop rotations throughout the flood plain. Floods also occur during the growing season nearly every year and damage growing crops. Over the past twenty years, floods have occurred an average of four times per year.

One of the largest floods in terms of duration and acres affected occurred in April 1967. The flood plain west of Bannister in Gratiot County was the most seriously affected area with over 5,200 acres of the 5,400 acre flood plain inundated for a period of up to three weeks. This storm was estimated a five year event. The winter wheat crop was damaged due to the duration of flooding and planting of spring crops was delayed, thereby reducing yields and quality of these crops. In addition, at least two growing season floods affected the flood plain area to a lesser extent during 1967. Total damages for that year were estimated $146,000.

Agricultural land in the flood plain is valued at $400 per acre. Land in the flood plain will for the most part remain in agriculture in the near future. This land will increase in value along with other agricultural land. Increases are not expected to exceed average agricultural land price increases due to the relatively projected growth and low demand for development property in this flood plain area.

TABLE 13 - Present Land Use in the Flood Plain

Land Use	Present Acres
Cropland	
Corn	2,300
Wheat	920
Oats	590
Navy Beans	540
Soybeans	3,330
Hay	1,710
Other Crops	280
Subtotal Cropland	9,670
Woods	1,450
Pasture	1,060
Idle	755
Other	665
TOTAL	13,600

Most of the annual flood damages result from water damage. Very little damage results from land voiding, scouring, and sediment deposition during floods. The estimated average annual floodwater damage is $376,300.

Floods do not directly threaten the lives of the people in the watershed, although floods do cause moderate indirect damages. When roads and bridges are made impassible, it has been necessary to reroute school buses, farm vehicles, and other local traffic for several miles. On-farm milk pick-up has been delayed due to road conditions with a resultant loss in milk quality, thus, a loss in farm income to the farm operator.

EROSION DAMAGE

The overall gross erosion rate for the watershed is about 3.0 tons per acre per year. Sheet erosion on the 121,230 acres of cropland occurs at an average rate of 3.5 to 4.0 tons per acre per year. This rate is 0.5 to 1.0 tons per acre above that allowable to maintain long-time productivity levels of the soils. The erosion rate on the 48,500 acres of forest, pasture, and other land is about 0.3 tons per acre per year. Other erosion damages occur locally on streambanks, roadside ditches, and scattered gullies. Damages from these sources are minor in the East Upper Maple Watershed.

SEDIMENT DAMAGE

Most of the sediment entering the channel system of the Maple River is derived from sheet erosion; some, however, is derived from upland gullies, roadsides, gravel works, and streambank cutting. These sources, other than from sheet erosion, constitute a very small percentage of the total sediment yield. Sediment deposited on flood plain areas during periods of overbank flow is generally in small quantities and is usually not the coarse, infertile, and detrimental type. Damages from this source are not large and have been included with floodwater damages.

Sediment deposition has occurred in all of the channels in the watershed. This has contributed to loss of capacity within the channels at certain points. The worst blockage of the Maple River Channel is in the vicinity of the confluence with Bear Creek in Gratiot County. It extends from McClelland Road downstream into the West Upper Maple Watershed to Blair Road. Test borings indicate sediment accumulations are in excess of four feet deep. This blockage is sufficient to block flow and to interfere with drainage. Damage from sedimentation within channels was not evaluated separately from floodwater damage.

Solids in suspension causes turbid water in tributaries, drains and the mainstream during periods of heavy rain and runoff. The volume of sediment leaving the watershed annually is estimated 15,000 tons.

DRAINAGE PROBLEMS

Inadequate channel depth and capacity cause impaired drainage on 23,500 acres (13,600 acres of which is also flooded) including 15,700 acres of cropland. Land use in the area damaged by impaired drainage is shown on Table 14. This indicates that cropland comprises 67 percent of the drainage problem area. Soybeans are the major crop with 23 percent, corn and hay are about 16 and 12 percent respectively. Pasture is the major non-cropland use with 12 percent.

TABLE 14 - Present Land Use in the Drainage Problem Area

Land Use	Present Acres	Present Percent
Cropland		
Corn	3,740	15.9
Wheat	1,500	6.4
Oats	950	4.0
Navy Beans	890	3.8
Soybeans	5,400	23.0
Hay	2,770	11.8
Other crops	453	1.9
Subtotal Cropland	15,700	66.8
Pasture	2,810	12.0
Woods	2,050	8.7
Idle	1,460	6.2
Other	1,480	6.3
TOTAL	23,500	100

There are 210 landowners in the problem area which includes the flood plain and adjacent lands requiring internal and surface drainage for efficient agricultural use. This area is also dependent upon the Maple River and its tributaries for drainage outlets. Damage from impaired drainage occurs primarily in the spring, but also occurs during the growing season and at harvest time.

Because of flooding and impaired drainage, it is often not possible to follow recommended crop rotations and cultural practices. This also has prevented many farmers from making necessary investments in land treatment measures. These conditions result in a lower quality product; less intensive land use; reduced yields and inefficient use of land, labor, and capital. In some areas, slow natural drainage also reduces forest productivity for marketable wood products. Access to forest land for harvesting is also inhibited by slow drainage.

The soil in the problem areas are predominately muck, clay loam and sandy loam which are somewhat poorly to very poorly drained. These soils have moderate to wide crop adaptability and impose severe limitations to crop production if not drained. These soils are highly productive if they are flood-free and adequately drained.

RECREATION PROBLEMS

The watershed is located in the heart of the most lakeless region in Michigan. There are only six lakes exceeding 100 acres in the vicinity according to information in "Michigan Lakes and Ponds." Only one of these lakes (Sleepy Hollow) will be satisfactory for public swimming. The nearest of the Great Lakes is nearly 80 miles. With the exception of the Sleepy Hollow State Park now under construction, the nearest existing state recreation area is located at Brighton, 45 miles southeast of the watershed. Public recreation facilities in the vicinity of the watershed are practically non-existant.

The watershed is surrounded by urban centers which exert a heavy demand upon existing recreation facilities. It is located approximately 20 miles from Lansing, the State capitol, and is within easy driving distance of Flint and Saginaw. There are an estimated 505,000 people

living within a 40 mile (1 hour) drive of the watershed. In addition, U. S. Highway 27, which passes three miles west of the watershed, is a major north-south route through central Michigan carrying many vacation-bound motorists.

Opportunities for hunting in the watershed are being curtailed severely due to increased posting of private land against trespassing. Many landowners are posting their land in protest of past damage done by sportsmen. If present trend continues, public owned land may be the only land available for hunting in the future.

Although pollution is evident in the drainage ditches, it has no known effect on the use of recreational resources. Sediment deposition has decreased channel capacities, slowed velocity and damaged fish habitat which has led to decreased fishing activity. Canoeing is difficult in several places on the Maple River during low flow because of a shallow channel, sand bars, and wood debris.

The projected population for Clinton, Gratiot, and Shiawassee Counties in 1990 is 68,484, 41,567, and 82,633 respectively. (Michigan Projected Population.) This entire portion of Southern Michigan is expected to have a sustained population growth. These trends indicate a high potential demand for recreation in the area. There is a definite need for a greater variety of recreational facilities. Land resources are available, although development of recreational enterprises has not been good over the years.

PLANT AND ANIMAL PROBLEMS

Flooding and poor drainage of cropland have resulted in fall plowing which eliminates the crop residue food source for wildlife. Small grain crops which are valuable wildlife food and cover have been replaced by less valuable soybeans which are tolerant to excess water and late planting. Flooding of wildlife nesting, denning and cover areas occurs during a 5-year flood. More fencerows and larger undisturbed strips of land along drains and tributaries are needed to provide more wildlife cover in areas of extensive cultivation. The watershed and surrounding area have a small total amount of water area and are located in a waterfowl flyway. There is a need for additional water acreage to provide for waterfowl nesting areas and migration resting areas.

Sediment deposition fills in pools and riffles used by fish and produces a less desirable channel bottom (sand, silt, and organic debris) in all channels for the production of aquatic food species used by fish, aquatic and semi-aquatic birds and mammals.

WATER QUALITY PROBLEMS

The village of Ashley operates a lagoon wastewater treatment system. Effluent from this flows into the Maple River. The village of Elsie does not have a municipal treatment system. A system of collection and secondary treatment is proposed. Discharge would be to the Maple River.

Ovid operates a lagoon which discharges semi-annually to the Maple River. Plans are underway to expand the system to serve 2,500 persons. The Michigan Milk Producers Association in Ovid operates a spray irrigation waste treatment system near the Maple River. Runoff from the area can flow into the river. This MMPA waste treatment system is presently operating under a NPDES permit which expires in 1979.

These discharges are not considered major pollutors at this time although local water quality degradation may exist. Future requirements may cause reevaluation of these sources. Planned project measures will not effect or be affected by these discharges.

ECONOMIC AND SOCIAL PROBLEMS

Sixty to seventy percent of the farm operators in the problem area work 100 or more days off the farm with many part-time farmers holding a full-time job outside the farm. Many farm operators hold part-time or full-time semi-skilled jobs in the automobile industries, machinery manufacturing, and chemical industries of nearby Lansing, Flint, and Saginaw at a wage rate of $3.00 to $4.00 an hour (1974). Some are employed in smaller factories in Alma, Mt. Pleasant, St. Johns, Owosso, Ithaca and Elsie. Several farm operators work as carpenters in the winter, after their crops are harvested, at wage rates of $4.00 to $5.00 an hour. In some cases, the wife also works. According to information

contained in the 1971 "Michigan Recreation Plan," there is some need of additional employment opportunities in the area, especially in the winter. Nearly all of the farms in the problem area are family farms using less than 1 1/2 man-years of hired labor.

RELATIONSHIP TO LAND USE PLANS, POLICIES, AND CONTROLS

Land, water and air are basic assets to be used and managed wisely to protect, conserve, and enhance their productivity and quality for all Americans. A land-use policy is the expression of society's determination of how its resource, land, is used. A land-use policy refers to the total of all those national, state, and local laws, ordinances, and attitudes affecting the short-term or long-term uses of land, private or public, through such mechanisms as ownership, inheritance, taxation, condemnation, zoning, redevelopment, building regulation, master planning and legislative fiat. The major responsibility for land-use policy (including planning and regulation) rests with local and state governments.

Michigan has no one State land use law. Numerous laws already on record contain provisions for regulating certain types of lands. There is nothing which ties these laws together nor is the enforcement vested with any one department. Many people feel, however, that there is a need for the State to take the leadership in this field and establish a policy.

Although there is no local master plan for the area, the proposed action conforms to current desires to help enhance and preserve prime agricultural, forest, and waterfowl habitat lands.

ENVIRONMENTAL IMPACT

CONSERVATION LAND TREATMENT

Installation of planned land treatment measures will result in an additional 31,865 acres being adequately treated. Currently there are 76,000 acres adequately treated. Many of the remaining acres in the watershed will receive some treatment. Conservation cropping systems, crop residue use, minimum tillage, critical area planting, grade stabilization structures, grassed waterways, pasture and hayland management, pasture and hayland planting, forest tree planting and forest hydrologic cultural operations will decrease the average annual erosion rate of the watershed from 3.1 tons per acre to an estimated 2.5 tons per acre; reduce sediment load in channels 40 to 60 percent; and reduce surface water runoff in the watershed four to six percent.

Drainage practices such as drainage mains or laterals, field ditches, and tile drains will improve agricultural efficiency. Improved drainage will allow farmers to get into their fields earlier in the spring; help prevent harvesting delays; permit the selection of higher yielding full season crop varieties; and permit a more effective weed control program.

Other land treatment measures such as conservation cropping systems, crop residue use, minimum tillage, and pasture and hayland planting and management applied to 28,400 acres of crop and pasture land will also increase agricultural production and efficiency as well as protect the land. These measures will increase net returns to land managers as well as make more efficient use of capital, labor, and other scarce resources. Minimum tillage practices will reduce the number of times a farmer must pass over a field, thereby reducing fuel consumption by an estimated 43,500 gallons annually.

The proposed forest land treatment measures will help maintain and improve the hydrologic condition on 2,450 acres of forest land. The additional litter and humus produced will improve infiltration and increase water storage capacity in the upland soils. On the edges of low, poorly drained forest lands, special tree and shrub plantings will reduce soil moisture, improve productivity, increase soil moisture

storage capacity, and help protect soil from erosion. Special tree and shrub plantings will provide wildlife food and cover and improve aesthetic quality.

Crop residue use and minimum tillage will provide wildlife food in the form of waste grain and terrestrial invertebrates. Drainage field ditches will produce aquatic plants, forage fishes, aquatic invertebrates and amphibians which, in turn, will be used for food by aquatic furbearers, waterfowl and shorebirds. Wildlife upland habitat management will retain, create, and manage wildlife habitat. Pasture and hayland management will provide wildlife food and cover by reestablishing long-term perennial, biennial or reseeding forage plants.

STRUCTURAL MEASURES

Structural measures will reduce flooding on 13,600 acres and improve drainage on a total area of 23,500 acres. Average annual acres flooded will be reduced from 14,790 acres without project (the same acres are flooded several times a year) to 1,080 acres with project. Damages due to flooding will be reduced since flood water will recede more rapidly. Flooding and impaired drainage will occur in the sump areas and collection ditches for 3-5 days during a 5-year frequency flood. This will affect primarily grassland, wet forest land, and pasture. Floodings of approximately 4,200 acres of wildlife cover outside of the levees will be reduced.

The present 25-year frequency discharge at the lower part of this watershed is estimated to be 4,225 cfs. With the project, the 25-year frequency discharge will be 6,240 cfs. The increased peak discharge will be contained by the West Upper Maple River levee system below this project. Increased flooding will also occur on the wet forested flood plain land in the Maple River State Game Area below Highway 27; however, no damages will result. No increase in flood levels will be experienced at Maple Rapids and downstream.

Structural measures will reduce flooding and improve drainage for 210 landowners. Most of these landowners are farm operators and depend upon the production of agricultural products as their primary source of income. There will be an estimated 89 percent decrease in average annual flood damage.

Erosion and sedimentation will increase during the construction of the single and multiple-purpose structures, levees, collection channels, floodway, pumping stations, recreation facilities and multiple-purpose channel. Sedimentation and turbidity will increase on the Maple River and Bear Creek during the 2.0 miles of suction dredging. Land treatment and structural measures will annually reduce sediment leaving the watershed by 70 percent, from 15,000 tons per year to 4,500 tons per year.

Construction from one side of the channel only will reduce potential disturbance on the opposite bank, allow equipment to avoid specific ecological areas, and leave critical shade trees. It will require less total work area although more area will be required on the one side worked. Larger equipment is required and spoil often must be moved twice to get it clear of the excavation area.

Reduced flooding will permit the restoration of former productivity on 125 acres of former cropland. Changed land use will result from the conversion of 2,375 acres of pasture, idle and forest land to crop production.

More intensive land use will result in reduced production cost, increased production, and improved crop quality. Improved drainage will allow farmers to get into their fields earlier in the spring; help prevent harvesting delays; permit the selection of higher yielding full season crop varieties; and permit a more effective weed control program. Consideration of high value, water-sensitive crops, such as navy beans and sugar beets, will become possible.

Future land use in the problem area with and without project including major crops is shown in Table 15. With the project, acres of wheat, navy beans and sugar beets increase. There is also an additional 3,200 acres of public land.

Future crop yields with project will increase an average of about 50 percent. The range varies from 30 percent or 1.5 tons per acre for hay to a high of 53 percent or 35 bushels per acre increase for corn.

An estimated 530 acres will be disturbed or changed with project action. These areas are composed of 184 acres of heavy woods and 346 acres of brush. With project action these areas will be converted to grass. Within the levee system area 222 acres will be disturbed. Table 16 indicates the changes in cover for this area.

TABLE 15 - Future Land Use in the Problem Area

Land Use	Future Acres Without Project	Percent Without Project	Future Acres With Project	Percent With Project
Cropland				
Corn	3,790	16.1	3,580	15.2
Wheat	1,730	7.3	2,870	12.2
Oats	530	2.3	280	1.2
Navy Beans	860	3.7	2,330	9.9
Soybeans	6,160	26.2	5,870	25.0
Hay	1,370	5.8	1,760	7.5
Sugar Beets	940	4.0	1,160	4.9
Peppermint	250	1.0	270	1.1
Spearmint	200	1.0	210	1.0
Potatoes	20	--	20	--
Subtotal Cropland	15,850	67.4	18,350	78.0
Pasture	2,060	8.8	1,520	6.5
Woods	2,830	12.1	1,510	6.4
Idle	1,480	6.3	840	3.6
Other	1,280	5.5	1,280	5.5
TOTAL	23,500	100	23,500	100

Permanent forest land losses due to the levees will be 0.2 percent of the total watershed forest land. Most of the cropland between the levees will likely change to grass land or forest land. A few acres will remain in crop production for use by wildlife. An increase in wildlife "edge effect" will occur from the installation of levees and collection channels on 95 acres of cropland. (See Figure 19.) Edge effect is known as the tendency for increased variety and density of wildlife species at community junctions; such as, grass land next to cropland and grass land next to water.

TABLE 16 - Total Land Cover Changes on Levee Disturbed Acres (Permanent and Temporary)

	Before Project	After Project	Permanent Change
Grass	52	145	+93
Tree, brush	39	0	-39
Crops	111	0	-111
Water	20	70	+50
Gravel	0	7	+ 7
TOTAL	222	222	

Wildlife habitat will be reduced on berms, levees, and cleared areas for up to three years. After this period, appreciable numbers of some species will be reestablished. There will be a permanent change in habitat and many species will not return. Alteration of habitat will result in a corresponding change in wildlife species composition. This change will benefit some wildlife species while severely reducing some endemic riparian populations.

Most of the wetland areas in the flood plain will not be altered by the project. There will be 14 acres of Type 6 and 143 acres of Type 7 wetlands within the levee system which will be part of the State Game Area. Much of the remaining 427 acres of brush and wooded swamp will be uneconomical to drain.

The planted cool season perennial grasses on the disturbed areas will provide good food and cover for ground-nesting birds and grazing mammals. Increases in the numbers of ground-nesting birds and small rodents are expected to occur on the newly established grass land. Mosquito breeding will be reduced on the 23,500 acres of land which will be protected from flooding while an increase in breeding will occur in the collection channels and in the wetland between the levees. There will be 2,500 acres of idle land, brush land and forest land wildlife habitat on 45 farms converted to cropland, a lesser value wildlife habitat. Brush piles between the levees will provide wildlife cover. Borrow pits between the levees will make small ponds for wildlife use. New public land managed for fish and wildlife will amount to 591 acres.

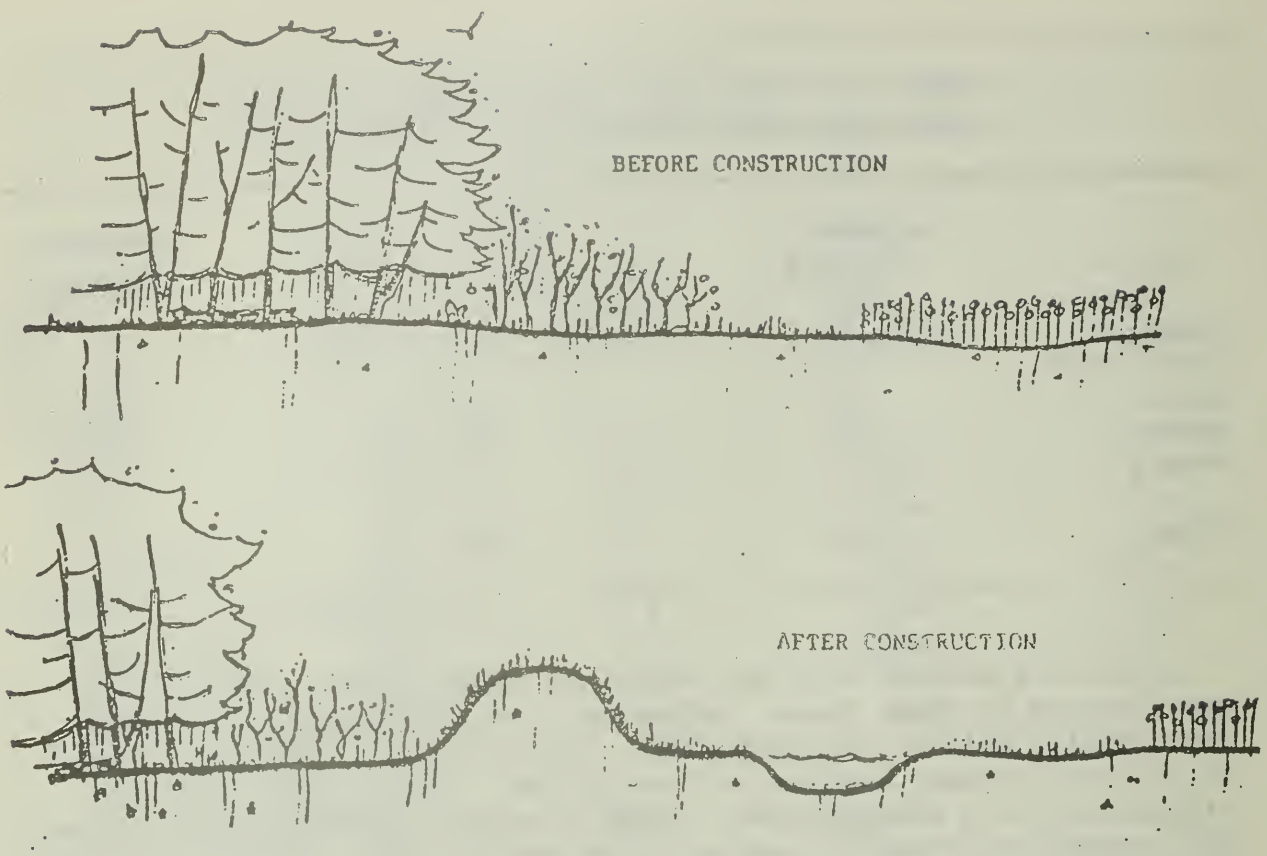


FIGURE 19 - EDGE EFFECT OF A TYPICAL LEVEE AND COLLECTION CHANNEL

With the project installed, all land between the levees will be owned by the Michigan Department of Natural Resources and will be a part of the Maple River State Game Area. Dredging of 2.0 miles of river will improve depth for canoeing.

The greatest amount of use of the Public Fish and Wildlife Development will occur during the hunting seasons (September 15 - December 31). Other use will be primarily during the fishing season (May - September). Maximum capacity of the access sites is 10 cars and 10 cars with trailers. Daily increase of traffic is expected to be minor and will create no problem for local roads or services.

An analysis of expected public fish and wildlife participation conducted by the Michigan Department of Natural Resources indicates 16,930 annual visits expected. Provision of access roads, parking and sanitary facilities will assure public access to the marsh area throughout the year. The number of recreation visits by activity is shown on Table 17.

TABLE 17 - Recreation Visits

Activity	Public Fish & Wildlife Development	Sleepy Hollow Development	Total
Fishing	900	xx	900
Deer Hunting-Bow	1,000	xx	1,000
Deer Hunting-Firearm	2,170	xx	2,170
Small Game Hunting	5,710	xx	5,710
Waterfowl Hunting	4,290	xx	4,290
Trapping	570	xx	570
Hiking	690	60,000	60,690
Canoeing	800	xx	800
Bird Watching	800	xx	800
Swimming	xx	400,000	400,000
Picnicking	xx	250,000	250,000
Camping	xx	130,000	130,000
Boating	xx	70,000	70,000
Nature Study	xx	20,000	20,000
Activity Games	xx	50,000	50,000
Miscellaneous	xx	20,000	20,000
TOTAL	16,930	1,000,000	1,016,930

Sleepy Hollow public recreation development is expected to provide 1,000,000 recreation visitations annually. The development is expected to attract campers and other visitors from nearby states as well as from other parts of southern Michigan. Most visitors, however, will originate within a fifty mile radius of the project, especially for day-use activities.

The recreation season is normally considered to extend from Memorial Day to Labor Day. Considerable nonseasonal use is expected in such activities as ice fishing, hunting, and snowmobiling.

Suction dredging of 2.0 miles and channel work on 43.9 miles of the Maple River and tributaries will destroy fish cover and lower densities of aquatic plants and invertebrates in the river bottom. With planned measures and management of the resource, fish habitat is expected to recover for some game fish species within a few years according to DNR biologists. Construction of low flow channels, and deeper pools with log or stone deflections will reduce the recovery time for the fish habitat.

Suction dredged deposits of 3 to 24 inches depth are expected on two acres of land which may destroy its value as Type 7 wetlands. Deposits of less than three inches will not destroy habitat values of wetlands.

Noise pollution and construction activity will displace wildlife during the construction period. An increase in noise, air, visual and solid waste pollution will occur as a result of an increase of 1,016,930 recreational visits per year.

ECONOMIC AND SOCIAL

Following installation of the project, farm income will increase due to increased production, increased efficiency, improved crop quality, and more intensive land use. The project will also encourage and enable farm operators to use better management techniques. These factors will lessen farm operators' dependence on off the farm employment and will increase the ability of family farms to stay in business.

Total average annual primary project benefits are estimated to be $2,317,600.. These benefits will accrue primarily to the local economy. Local secondary benefits will accrue to processors, handlers, and suppliers of goods and services. These are entirely of a local nature and will accrue within the immediate zone of project influences. Since the watershed has a limited capacity to supply goods and services, there will be little multiplier effect within the hydrologic boundary.

The increased expenditure for agricultural goods and services within the area will be relatively small, as witnessed by the $324,800 in secondary benefits. It is also expected that the increased expenditure for consumer goods and services within the watershed area will be small. This means that the major effect on the local economy will be limited mainly to the initial impact of the $2,642,400 average annual primary and secondary benefits. Appendix A summarizes the costs and benefits for the project.

Any reduction in or lack of available funds for the project would require a revision of the project or abandonment until funds were available.

FAVORABLE ENVIRONMENTAL EFFECTS

a) Adequately treat 31,865 acres of cropland, pasture land against erosion.
b) Reduce average annual watershed erosion rate from 3.1 tons per acre to 2.5 tons per acre.
c) Reduce sediment load transported in channels 40 to 60 percent.
d) Reduce surface water runoff in the watershed by 4 to 6 percent.
e) Improve agricultural efficiency on 28,400 acres of crop and pasture land.
f) Reduce annual fuel consumption on cropland by 43,500 gallons.
g) Provide additional food and cover for wildlife as a result of conservation land treatment.
h) Reduce flood damages received by 210 landowners on 13,600 acres.
i) Improve drainage on 23,500 acres.
j) Reduce flooding to about 4,200 acres of terrestrial wildlife cover outside of levees and channels.
k) Reduce residential flood damages by $1,700 annually.
l) Reduce annual road and bridge flood damages by $4,500.
m) Reduce sediment leaving the watershed by 70 percent from 15,440 tons per year to 4,500 tons per year.
n) Convert 2,325 acres of pasture, idle and forest land to crop production.
o) A change in use of 39 acres of forest land, 52 acres of grassland, and 111 acres of cropland to 145 acres of grassland, 50 acres of water area, and 7 acres of gravel road surfaces.

p) Increase wildlife "edge effect" on about 95 acres.
q) Increase numbers of ground-nesting birds and small rodents in the vicinity of channels and levees.
r) Create new wildlife cover by building brush piles between the levees.
s) Reduce mosquito breeding on 23,500 acres of land.
t) Add 591 acres of new public land managed for fish and wildlife.
u) Improve river depth for canoeing on 2 miles of river.
v) Provide new recreation opportunities (picnicking, camping, swimming, hunting, fishing, canoeing) for 1,016,930 recreation visits.
w) Provide project benefits of $2,642,400 in the local economy.

ADVERSE ENVIRONMENTAL EFFECTS

a) Increase erosion and sedimentation during installation of structural measures.
b) Increase sedimentation and turbidity in the Maple River during the construction period of five to seven years.
c) Reduction of wildlife habitat on structural measures (about 530 acres) for up to 3 years.
d) Create possible mosquito breeding area on 7 acres of new water in collection channel.
e) Reduce fish cover and lower densities of aquatic plants and invertebrates on 45.9 miles of river bottom for several years.
f) Displace wildlife during construction activity.
g) Increase in noise, air, visual, and solid waste pollution as a result of 1,016,930 additional recreation visits.
h) Decrease value of two acres of Type 7 wetland due to spoil deposits.
i) Loss of nonrenewable fuel used during the construction period and the operation of pumping stations.
j) Increase in flood flows and flooding in the State Game Area below Highway 27.
k) Possible increase in stream water temperatures.
l) Decrease total forest land by 1,320 acres.
m) Convert 2,375 acres of pasture, idle and forest land to crop production, a lower value wildlife habitat.
n) A change in use of 39 acres of forest land, 52 acres of grassland, and 111 acres of cropland to 93 acres of grassland, 50 acres of water area, and 7 acres of gravel road surfaces for a net economic loss.

ALTERNATIVES

As in any project there are numerous alternatives and combinations thereof which can be considered. Many of these are strictly engineering variables of the same basic project and are not considered separate alternatives. However, of the others, not all are realistic, and many were considered to a point where they proved to be impossible or unworkable. Five alternatives in addition to the no project alternative appeared to be the most reasonable and are discussed further. These include accelerated land treatment, purchase of the flood plain, diking and pumping, two flood control dams alone, and no project action.

ALTERNATIVE 1 - ACCELERATED LAND TREATMENT

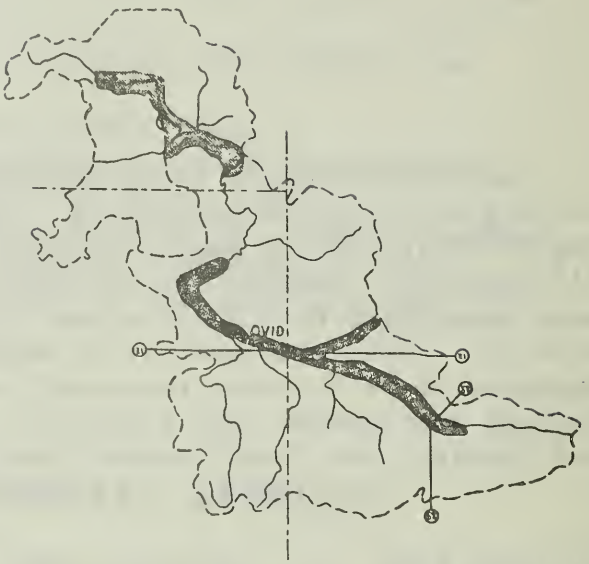
The traditional approach of accelerated conservation land treatment by working with landowners to install conservation practices on their land which would minimize soil erosion and reduce flooding is one alternative. Installation of such measures as conservation cropping systems, tree planting, windbreaks and forest management would be beneficial in reducing erosion, sediment and surface runoff. Sediment damages would reduce about 50 percent. In addition, many conservation practices of this type tend to improve the visual quality of the landscape and improve wildlife habitat.

These measures would reduce surface runoff by 2 percent. Much of the tile drainage and field ditches included in the proposed project would not be feasible if the channel measures were not installed. The cost of this alternative is estimated at $505,000.

A damage reduction of $1,150 (less than one percent) annually would occur.

ALTERNATIVE 2 - PURCHASE OF FLOODPLAIN

This alternative involves the purchase of the entire flood plain to preserve it in its present condition for use as a recreation, fish and wildlife area. An accelerated land treatment program for erosion control is included in this plan. Approximately 14,000 acres would need to be purchased including some tracts where the farm unit would no longer be economical. Flood damage would be avoided on the land purchased, however, the 9,700 additional acres needing improved drainage would remain as a problem.



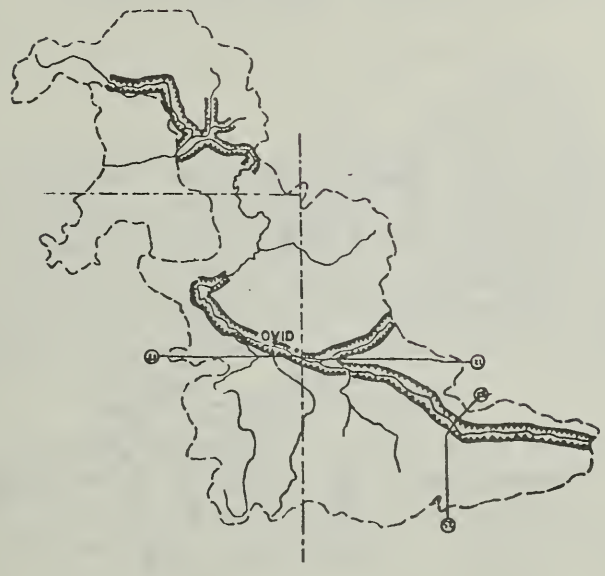
Land treatment program would be primarily on land outside of the flood plain and consist of erosion control and management practices. Local drainage measures would not be practical since no outlet would be available. Cost of this treatment would be $505,000.

Land cost of this alternative would be approximately $11 million. It would result in relocation of about 90 families. Relocation expenses could add nearly $2 million to the cost. New legislation would probably be required since no public agency now has authority or funding to do this.

Impacts resulting from the alternative include preservation of the land for wildlife habitat and open new mileage of stream to fishing. Flood damage would be avoided on 14,000 acres of cropland but production of crops would also be eliminated.

Loss of farm income would drastically effect the economy of the area since it is now farm oriented. Benefits would be foregone on 9,700 acres outside of the flood plain needing drainage which could not be met with this alternative.

ALTERNATIVE 3 - DIKE RIVER AND PUMP AGRICULTURAL AREAS



This alternative would consist of building dikes in the entire area where channel work is proposed and an accelerated land treatment program. Approximately 96 miles of dike would be needed. All agricultural and residential areas within the benefit area would need to be served with collection ditches and pumps. Levees, ditches and pumps similar to those described in the Planned Project section of this statement would be required. About 15 pump stations are necessary. The channel and banks would not be disturbed except where pump outlets occur. Several tributary streams would require either additional diking or extensive pumping.

The level of protection provided to the agricultural cropland would be the same as in the selected plan. All recreation benefits and some of the fish and wildlife benefits would not occur with this program. Land treatment costs are $1.7 million. Construction cost for dikes, pumps and collection ditches would be $14,218,000. Land costs would be approximately $500,000. Annual operation cost would be much higher with dikes and pumps than with channel work.

Land needed for the structural measures would be taken mostly from cropland with some forest, pasture, and other land included. Fish and wildlife habitat would be preserved. The system depends entirely on pumps for protection which gives some people an insecure feeling. The pump system would run through much of the year and require extensive maintenance and fuel.

ALTERNATIVE 4 - TWO FLOOD CONTROL STRUCTURES ONLY

An accelerated land treatment program and construction of the Bear Creek dam to function along with the already installed Sleepy Hollow is another alternative. This dam would be built as outlined in the Planned Project section of this statement. The structures will provide recreation benefits and some flood reduction benefits. Land treatment program would be as described in Alternative 2. It is estimated that the flood damages would be reduced by about 10 percent by this alternative. The estimated cost of this proposal is $6.1 million.

The small reduction in flood damages would not be of much value to the farmers since it is far less than protection against the one-year storm. The 9,700 acres of impaired drainage will continue to lack an outlet. Existing fish and wildlife values would remain essentially unchanged. Impacts from the structure site will be minimal since it is designed as a dry dam.

ALTERNATIVE 5 - DIKE AND PUMP , OVID TO DUPLAIN

Development of levees and pump systems to substitute for the segment of channel between Ovid and DuPlain is in this alternative. The rest of the Planned Project would be retained including accelerated land treatment. Approximately 10 miles of channel work would be eliminated and replaced with 20 miles of levees and collection ditches. Four pumping stations and tie-back dikes on Alder Creek and Little Maple River would be required.

This system would gain all of the benefits to agricultural land of the Planned Project and would protect this segment of the river from disturbance. It is estimated that elimination of channel work would reduce total costs by $1 million. The added cost of levees and pumps would be about $3 million for a net increase of $2 million in the project cost. Cost of operation and maintenance for the pump stations would be four times that of channel only alternative.

Desired flood damage reduction and drainage would be obtained with this program. There would be some added benefits to fish and wildlife. Land disturbed for the levees would be more than twice that needed for channels. More of the disturbed area would be cropland and less in woodland.

ALTERNATIVE 6 - NO PROJECT ACTION

Failure to implement this project would result in a further deterioration of resources, declining crop production, continued damage to improvements including highways, and inhibit economic development of the area. The watershed would remain essentially as described in the "Environment Setting" section of this report, and would be plagued with problems which led to the initiation of this project. Although the Soil Conservation Service ongoing programs would continue to function and provide technical assistance for the installation of land treatment and resource planning, it would not be at the accelerated rate.

Additional recreational visits to be available with the project will not be available.

SHORT TERM vs. LONG TERM USE OF RESOURCES

Land use in the area is predominantly agriculture. Trends are expected to remain primarily agriculturally oriented. Population trends in the area have shown a slight increase and are expected to continue. The demand for land for residential use in the southern and eastern parts of the watershed are expected to increase moderately. The demand for residential use in the remaining watershed is not expected to increase markedly until after 1980. The watershed for the most part will stay in agriculture and a State Game Area. The main purpose of the East Upper Maple project is to improve the efficiency of use and to maintain the productivity of agricultural lands in the watershed. Production efficiency of these lands will be increased for both the present and forseeable future.

The Grand River Basin Comprehensive Water Resources Planning Study was begun in 1963 to identify short- and long-term needs for national economic development, regional development, environmental enhancement, and the well-being of the people. The objective was to promote wise use of the Basin water and related land resources. The comprehensive study was made through cooperative efforts of agencies of the Federal government, the State of Michigan and local governments.

The East Upper Maple River Watershed project implements the following recommendations of the Grand River Basin Study:

1. Enhance water quality through sediment reduction.
2. Provide flood plain areas for low key recreation.
3. Maintain Michigan Department of Natural Resource's acquisition program of state game lands.
4. Purchase of wetlands in high priority waterfowl production areas.
5. Carry out a ten-year accelerated land treatment program in the Basin.
6. Reduce damages from flooding and impaired drainage in the Upper Maple River Watershed.
7. Develop two flood retarding structures.
8. Develop a major recreation facility.

In the short-term, construction activity will cause turbidity, sediment, noise pollution, and degraded aesthetic quality for up to three years. Loss of wildlife cover will occur for up to three years on disturbed areas. Lower densities of aquatic and semi-aquatic species of plants, invertebrates, and vertebrates will occur for up to 15 years on 45.9 miles of channel.

In the long-term, terrestrial and aquatic animal and plant productivity of land and water resources will increase by the application of land treatment measures and the management of 591 acres of new state game land. Land treatment and structures will improve water quality. Water and land related recreational activities will increase as a result of an additional 591 acres of new State Game Land and 1,480 acres of Sleepy Hollow recreation area.

Flood control, drainage improvement and fish and wetland wildlife development are long-term considerations. Agricultural improvements as a result of the project may make it more difficult to change to other long-term use options but does not preclude these options. Since agriculture and wildlife will be the predominant land use in the future, the project is compatible with projected long-term use of the land. Installation of conservation practices with flood control and drainage improvements will be effective in conserving land and water resources beyond the designated project life.

The East Upper Maple River Watershed is in the Grand River Basin which is in the Lake Michigan Sub-Basin of the Great Lakes Water Resource Region. Other Public Law 566 projects located in the Grand River Basin are listed in Table 18. Their main objective is to protect and enhance (flood control and drainage) the existing agricultural land.

TABLE 18 - Existing PL-566 Projects in the Grand River Basin

Project	Acres	Status
Catlin Waters	2,800	Completed
Muskrat Creek	7,650	Completed
Fowlerville Drain	1,500	Undergoing Reformulation
West Upper Maple River	25,730	Under Design
Rogue River	155,760	Planning
Hayworth Creek	66,810	Planning Suspended
Stony Creek	108,800	Planning Suspended

The West Upper Maple River Watershed Project is downstream and adjacent to the East Upper Maple River Watershed Project. These two watersheds were planned as a unit and the projects were formulated as one. Nearly 200,000 acres of drainage area are included in the two watersheds. Project measures were developed and evaluated at the same time.

The levee and pump system downstream of Bannister is planned to connect with the project measures of the West Watershed. They are dependent upon each other and the entire measure is needed to realize the full benefits of the projects. Design of the channel work and the levees in the East and West Maple River projects are both dependent upon the completion of the two flood retarding structures. For proper functioning of the system, the dam must be built before the channel and levees.

Significant cumulative environmental effects will occur upon completion of both projects. Basic land treatment measures will be applied to 32,000 acres of cropland, 750 acres of pasture land, 2,700 acres of forest land, and 1,110 acres of other land to adequately treat and protect these acres. Structural measures planned for both projects include 43.9 miles of multiple-purpose channel work, 1.1 mile of floodway, 21.2 miles of levee construction, 19.8 miles of collection channels, 1.1 mile of snagging, 3.8 miles of suction type dredging, 4 pumping stations, 1 multiple-purpose structure, 1 single-purpose structure, one recreation development, and two fish and wildlife developments with 7 public access sites.

The levees, collection channels and pumping stations were planned and designed together as an interrelated unit to solve the flooding and drainage problems on the 15,360 acre problem area between Bannister and Highway 27. Suction-type dredging on the Maple River in both the East and West portions were designed to reduce required pumping. Effects of channel work and the two flood water retarding structures in the East Upper Maple River Project were considered in the design of the levees. Downstream peak flows will be higher, but they will have no significant environmental effect. The first nine miles downstream from the West Upper Maple Watershed are in the Maple River State Game Area, and the flood plain is managed as Type 4 and 7 wetlands.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Construction of dam levees, collection channels, pumping stations, access roads, parking lots and public access areas will result in the irretrievable commitment of about 111 acres of cropland and 39 acres of woodland. The project will commit 591 acres of flood plain to wildlife and recreation use.

Labor, fuel and materials needed for the construction, operation, and maintenance of the structural measures will be irretrievably lost.

CONSULTATION AND REVIEW WITH APPROPRIATE AGENCIES AND OTHERS

GENERAL

General consultation and coordination among local, State and Federal agencies has been comprehensive during the history of this project development. From 1963-1971, meetings were held with the steering committee, sponsors, interested local landowners, Soil Conservation Service, Forest Service, Michigan Department of Agriculture, Michigan Department of Natural Resources, U. S. Fish and Wildlife Service, Army Corps of Engineers, Bureau of Public Roads, Tri-County Planning Commission, Michigan Water Resources Committee, and the Farmers Home Administration.

An Environmental Impact Statement was prepared and filed with CEQ in 1970. Revisions to the planned project have made a revised statement necessary. Changes in the plan which are included in the project were developed in consultation with the sponsors, Michigan Department of Natural Resources, and other State and Federal agencies. Written requests were made to the National Park Service and the State of Michigan for historic and archeological information pertaining to the watershed. Several meetings and discussions have been held with the State History Division to coordinate study needs. Procedures for carrying out the archeological study now in progress were developed jointly with the State Historic Preservation Officer.

A public information meeting was held in Elsie, Michigan on January 16, 1975. Preliminary draft revised environmental impact statement had been mailed to 60 sponsors, environmental and conservation groups, newspapers and concerned citizens. After an overview of the project was presented, individuals were given an opportunity to comment. Several verbal and written comments were received and incorporated into the draft statement.

Following is a list of agencies and other sources from which written comments on the draft environmental impact statement have been requested.

Department of Agriculture - Office of Equal Opportunity
Department of the Army
Department of Commerce
Department of Health, Education, and Welfare
Department of the Interior
Department of Transportation
Environmental Protection Agency
Advisory Council on Historic Preservation
Federal Power Commission
Great Lakes Basin Commission
Governor of Michigan
State Clearinghouse
Tri-County Regional Planning Commission
East Central Michigan Planning and Development Regional Commission
GLS Regional Planning and Development Commission
Natural Resources Defense Council
Friends of the Earth
Environmental Defense Fund
National Wildlife Federation
National Audubon Society
Environmental Impact Assessment Project
USDA Agriculture and Stabilization Service - Michigan
USDA Farmers' Home Administration - Michigan
Michigan Senate - Agriculture Committee
Michigan Senate - Conservation Committee
Michigan House of Representatives - Conservation Committee
Michigan House of Representatives - Drainage Committee
Michigan Department of Agriculture
Michigan Department of Agriculture - Soil & Water Conservation Division
Michigan Department of Natural Resources
Michigan Soil Conservation Districts, Inc.
Michigan State University - College of Agriculture and Natural Resources
University of Michigan - School of Natural Resources
Cooperative Extension Service
Clinton County Board of Commissioners
Gratiot County Board of Commissioners
Shiawassee County Board of Commissioners

Grand River Watershed Council
Michigan State Chamber of Commerce
Michigan League of Women Voters
Michigan Association of Conservation Ecologists
Michigan Audubon Society
Michigan Botanical Club, Inc.
Michigan Natural Areas Council
Michigan United Conservation Club
Sierra Club - Conservation Committee
The Nature Conservancy - Michigan Chapter
Trout Unlimited, Michigan Council
West Michigan Environmental Action Council
Michigan Student Environmental Confederation
Gratiot County Herald
Lansing State Journal
Flint Journal
Consumers Power Company
Mid-Michigan District Health Department
Wilber Smith and Associates
Research Institute of Michigan
Michigan State University - Resource Development Department
Michigan Farm Bureau - Legislative Council

DISCUSSION AND DISPOSITION OF EACH COMMENT ON DRAFT ENVIRONMENTAL IMPACT STATEMENT

(This section will be included only in the final environmental impact statement.)

LIST OF APPENDICES

Approved By Arthur H. Cratty Date May 16, 1975

Arthur H. Cratty
State Conservationist

APPENDICES

APPENDIX A

COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES
East Upper Maple River Watershed, Michigan

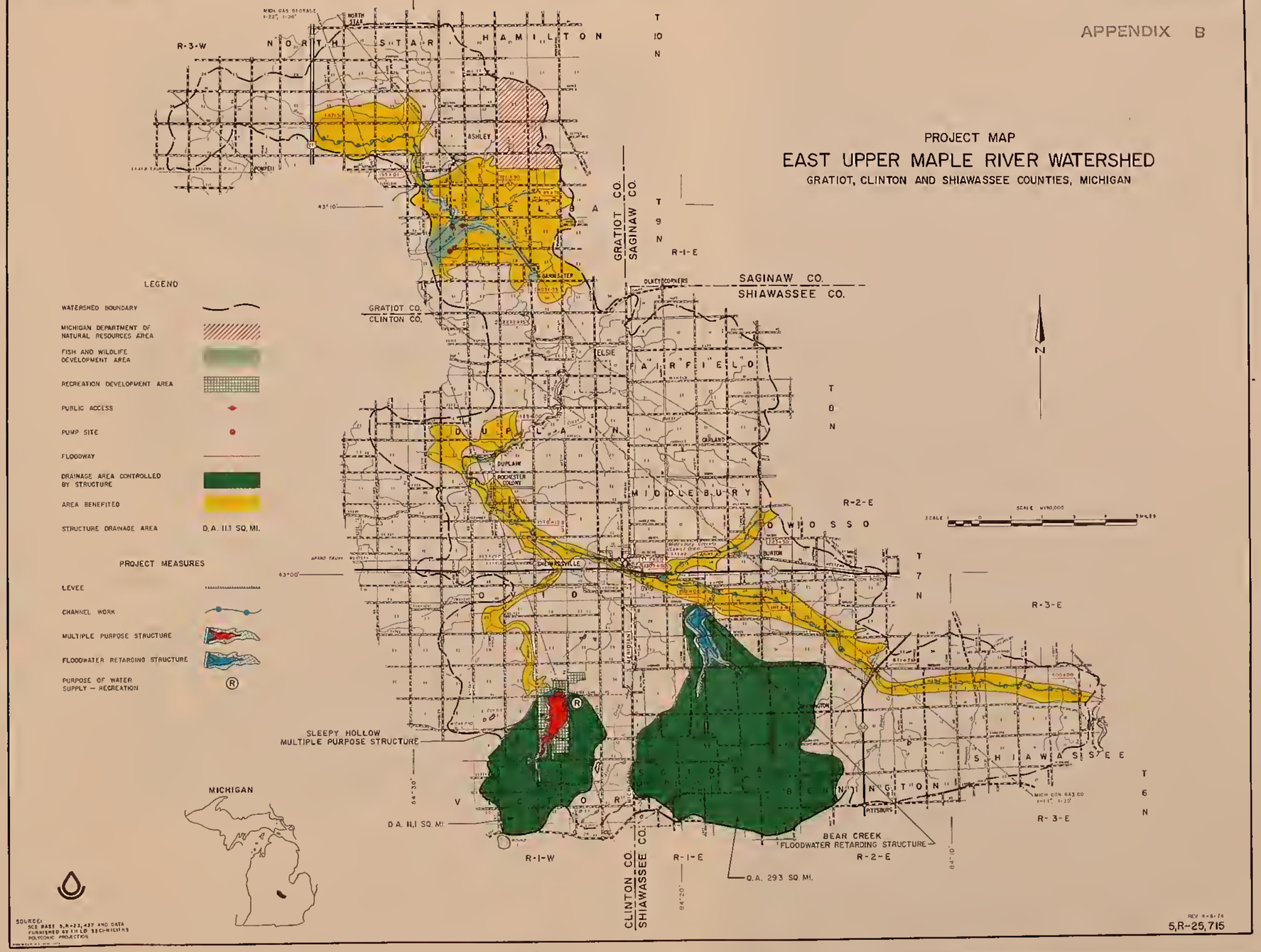
Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/								Average Annual Cost 3/	Benefit Cost Ratio
	Damage Reduction	More Intensive Land Use	Changed Land Use	Drainage	Recreation	Fish and Wildlife	Secondary	Total		
All Structural Measures	352,100	264,900	19,100	301,000	1,357,500	23,000	324,800	2,642,400	966,000	2.7:1.0
Project Administration									73,700	
GRAND TOTAL	352,100 2/	264,900	19,100	301,000	1,357,500	23,000	324,800	2,642,400	1,039,700	2.5:1.0

1/ Price base: Current normalized, WRC October, 1974, for crop and pasture; 1974 for all others.
2/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of $4,000 annually.
3/ Fish and wildlife development amortized 50 years at 5 7/8 percent. All other cost amortized 50 years at 4 7/8 percent.

PROJECT LOCATION MAP
UPPER MAPLE RIVER WATERSHED

U. S. DEPARTMENT OF AGRICULTURE — SOIL CONSERVATION SERVICE

PROJECT MAP
EAST UPPER MAPLE RIVER WATERSHED
GRATIOT, CLINTON AND SHIAWASSEE COUNTIES, MICHIGAN



REV 4-6-78
5,R-25,715

APPENDIX C - SELECTED REFERENCES

Benson,Robert, Wildlife Biologist, Michigan Department of Natural Resources, Personal Letter, March, 1973.

Chartkoff, Joseph and Korry,K., *Preliminary Report on Archeological Resources of the East Upper Maple River Watershed,* unpublished, 1975.

Clinton County Soil Conservation District, *An Appraisal of Potentials for Outdoor Recreational Development,* 1967.

Dames and Moore, Environmental Consultants, *Report of Geologic Investigation, Upper Maple River Watershed, Gratiot, Clinton, Shiawassee Counties,* Park Ridge, Job Number 2172-009-07, September 1973.

Gratiot County Soil Conservation District, *An Appraisal of Potentials for Outdoor Recreational Development,* 1967.

Great Lakes Basin Commission, Wildlife Work Group, *Great Lakes Basin Framework Study, Appendix 17, Wildlife,* Draft No. 1, Lebanon: Bureau of Sport Fisheries and Wildlife, U. S. Department of Interior, 1971.

Michigan Department of Agriculture, Michigan Weather Service and U. S. Department of Commerce, NOAA National Weather Service, *Climate of Michigan by Stations,* 2d. rev. ed., East Lansing: Michigan Weather Service, 1971.

Michigan Department of Conservation, Geological Survey Division, *Map of Surface Geology,* Publication 49, 1955.

Michigan Department of Conservation, Water Resources Commission, *Water Resources of the Lower Lake Michigan Drainage Basin,* Lansing: Water Resources Commission, 1968.

Michigan Department of Natural Resources, Comprehensive Studies, *Background Water Quality,* Storet Retrieval, October 1973.

Michigan Department of Natural Resources, Fish Division, *Stream Classification Maps*, Lansing: Michigan Department of Natural Resources, 1967.

Michigan Department of Natural Resources, "Inventory of the Fisheries Resources of the Upper Maple River Watershed" (unpublished 1974).

Michigan Department of Natural Resources, Planning Services, *Michigan Recreation Plan*, 1971.

Michigan Department of Natural Resources, Water Resources Commission, *Fish kill on Maple River*, unpublished memorandum, September 7, 1973.

Michigan Department of Natural Resources, Water Resources Commission, *Water Quality Standards, Part 4 of General Rules*, 1973.

Michigan Office of Management and Budget, *Michigan Projected Population 1970-1990*, 1972.

Michigan State Highway Commission, *Michigan Official Highway Map*, Grand Rapids: Michigan Lithographing Co., 1971.

Michigan State University, Agricultural Experiment Station and Cooperative Extension Service, *Project 80 and 5*, "The Economic, Social, Political and Technological Climate for Rural Michigan in 1985" (Summary of Phase I Papers), 1972.

Michigan State University, Department of Resource Development, *Michigan Lakes and Ponds*, 1965.

Michigan State University, Graduate School of Business Administration, Division of Research, *Michigan Statistical Abstract*, 9th ed., 1972.

Pettyjohn, Wayne E., *Water Quality in a Stressed Environment*, Minneapolis: Burgess Publishing Co.

Shiawassee County Soil Conservation District, *An Appraisal of Potentials for Outdoor Recreational Development*, 1970.

U. S. Department of Agriculture, Agricultural Research Service, *Agriculture Handbook No. 282*, "Predicting Rainfall-Erosion Losses from Cropland East of the Rocky Mountains," 1965.

U. S. Department of Agriculture, Economic Research Service in cooperation with the Michigan Agricultural Experiment Station/ Michigan State University, *Statistical Supplement to Agricultural Economic Report 108*, "An Economic Survey of the Northern Lake States Region", 1969.

U. S. Department of Agriculture, Forest Service, *Forest Service Report, East Upper Maple River Watershed*, unpublished, May, 1968.

U. S. Department of Agriculture, Soil Conservation Service, *Agriculture Handbook No. 210*, "Land-Capability Classification", September 1961.

U. S. Department of Agriculture, Soil Conservation Service, *Atlas of River Basins of the United States*, 2d. ed. Washington: Government Printing Office, 1970.

U. S. Department of Agriculture, Soil Conservation Service, *Engineering Memo-SD-15*, "Procedure for Estimating the Sediment Storage Requirements of Storage Reservoirs," Huron: SCS, 1966.

U. S. Department of Agriculture, Soil Conservation Service, *Procedure for Computing Sheet and Rill Erosion on Project Areas*, Technical Release No. 51, 1972.

U. S. Department of Agriculture, Soil Conservation Service and the Michigan Agricultural Experiment Station, *Soil Survey of Clinton County, Michigan*, unpublished.

U. S. Department of Agriculture, Soil Conservation Service and the Michigan Agricultural Experiment Station, *Soil Survey Gratiot County, Michigan*, unpublished.

U. S. Department of Agriculture, Soil Conservation Service, *Technical Guide*, "Maximum Crop Management Factor Values", 1963.

U. S. Department of Agriculture, Soil Conservation Service, *Technical Guide*, "Soil Erodibility "K" Values and Soil Loss Tolerance "T" Value", 1964.

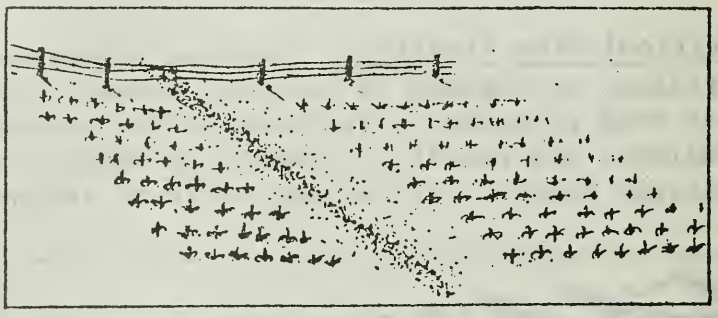
Crop Residue Use - Using plant residues to protect cultivated fields during critical erosion periods. The purpose is to conserve moisture; increase infiltration; reduce soil loss; and improve soil tilth. It is applicable on land where adequate crop residues are produced.

Drain - A conduit, such as tile, pipe, or tubing, installed beneath the ground surface and which collects and/or conveys drainage water. A drain may serve one or more of the following purposes:

1. Improve agricultural production by lowering the water table.
2. Intercept and prevent water movement into a wet area.
3. Relieve artesian pressures.
4. Remove surface runoff.
5. Facilitate leaching of saline and alkali soils.
6. Serve as an outlet for other drains.
7. Provide ground water regulation and control for sub-irrigated areas.

Drains are used in areas having a high water table where benefits of lowering or controlling groundwater or surface runoff justify the installation of such a system.

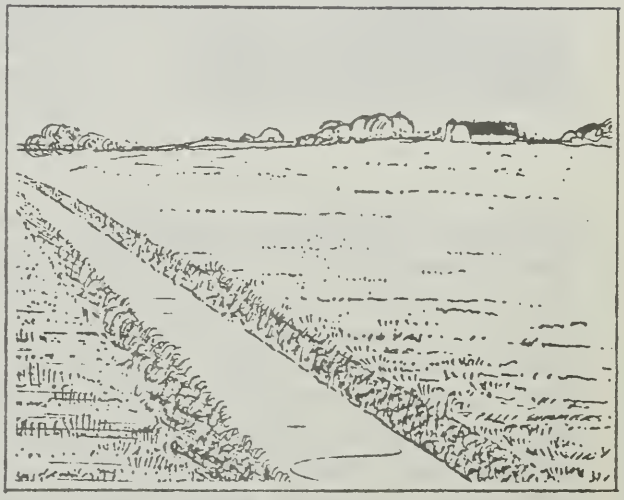
Drainage Field Ditch - A graded ditch for collecting excess water within a field. This does not include Drainage Main or Lateral, or Grassed Waterway or Outlet. Applicable sites are flat or nearly flat lands that:



1. Have soils of low permeability or shallowness over barriers, such as rock or clay, which hold or prevent ready percolation of water to a deep stratum.
2. Have surface depressions or barriers which trap rainfall.
3. Have insufficient land slope for ready movement of runoff across the surface.
4. Receive excess runoff or seepage from uplands.
5. Require removal of excess irrigation water.
6. Require control of the groundwater table.
7. Have adequate outlets available for disposal of drainage water by gravity flow or pumping.

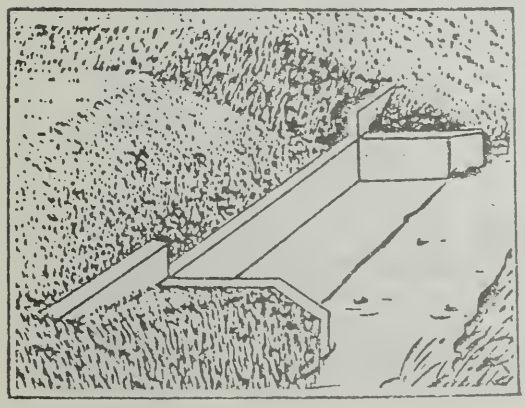
Drainage field ditches are installed to:

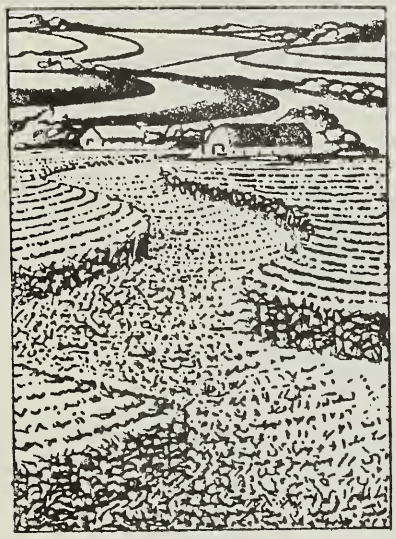
1. Drain surface depressions.
2. Collect or intercept excess surface water such as sheet flow from natural and graded land surfaces or channel flow from furrows for removal to an outlet.
3. Collect or intercept excess subsurface water for removal to an outlet.



Drainage Main or Lateral - An open drainage ditch constructed to a designated size and grade. Does not include Drainage Field Ditch. The purpose of mains and laterals is to dispose of excess surface or subsurface water, intercept groundwater, or to control groundwater levels; to provide for leaching of saline or alkali soils; or a combination of these objectives.

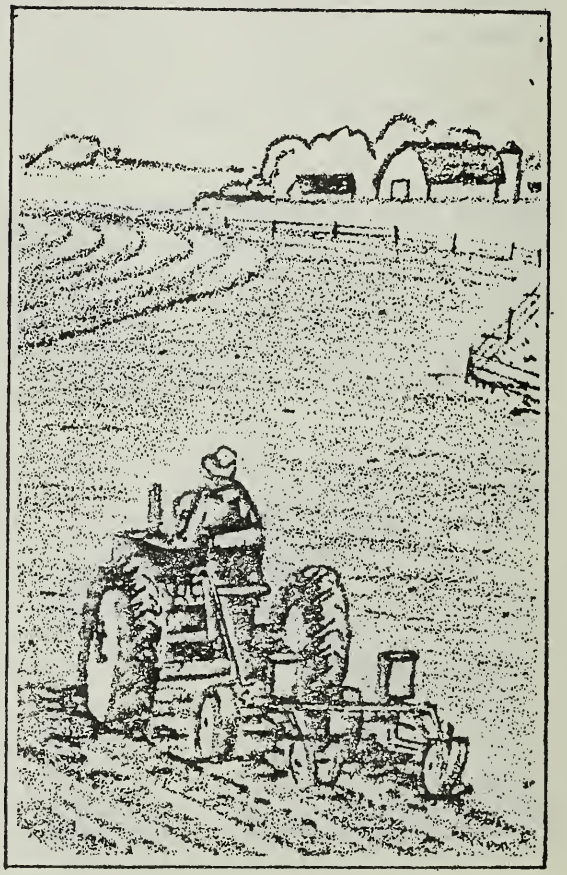
Grade Stabilization Structure - A structure to stabilize the grade or to control head cutting in natural or artificial channels. (Does not include straight pipe overfill structures used in drainage and irrigation systems for structures for water control). Grade stabilization structures are installed to stabilize the grade in natural or artifical channels, prevent the formation or advance of gullies, and reduce environmental and pollution hazards. These structures apply where the concentration and flow velocity of water are such that structures are required to stabilize the grade in channels or to control gully erosion. Special attention will be given to maintaining or improving habitat for fish and wildlife, where applicable.





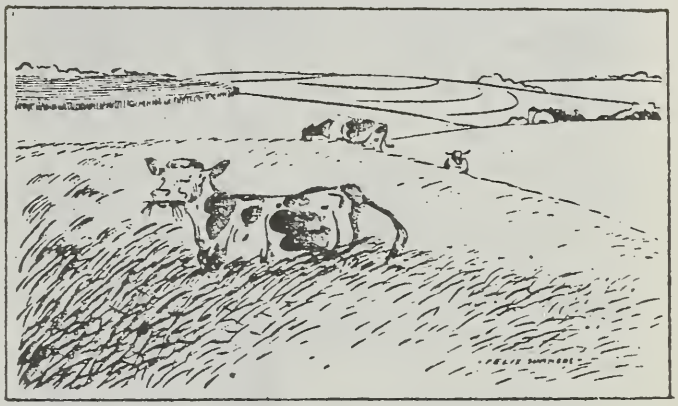
Grassed Waterway or Outlet - A natural or constructed waterway or outlet shaped or graded and established in vegetation suitable to safely dispose runoff from a field, diversion, terrace, or other structure. The purpose is to prevent excessive soil loss and formation of gullies. It is applicable where concentrated runoff must be disposed of at safe velocities.

Hydrologic Cultural Operations - These operations improve forest hydrologic conditions through increased development of litter and humus and maintenance of adequate vegetative cover. These objectives are reached by favoring the establishment and development of desirable species and maintaining stand and stocking conditions favorable to rapid growth and production of maximum amounts of litter and humus. Hydrologic cultural operations include thinnings, weeding, release, salvage and harvest cuts.

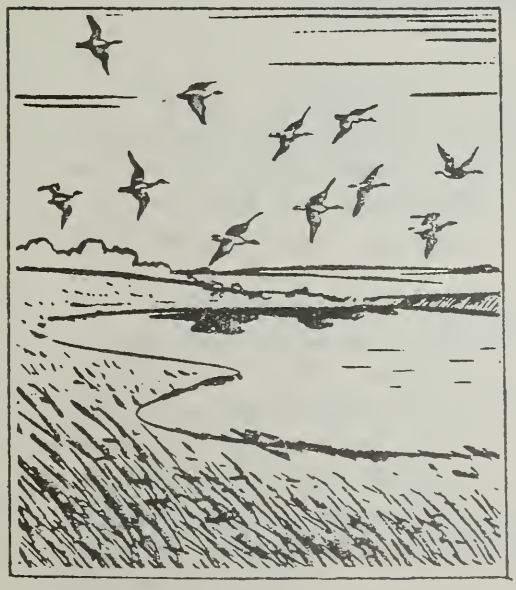


Minimum Tillage - Limiting the number of cultural operations to those that are properly timed and essential to produce a crop and prevent soil damage. The purpose is to retard deterioration of soil structure; reduce soil compaction and formation of tillage pans; and to improve soil aeration, permeability, and tilth. It is applicable on all cropland and on certain recreation and wildlife land.

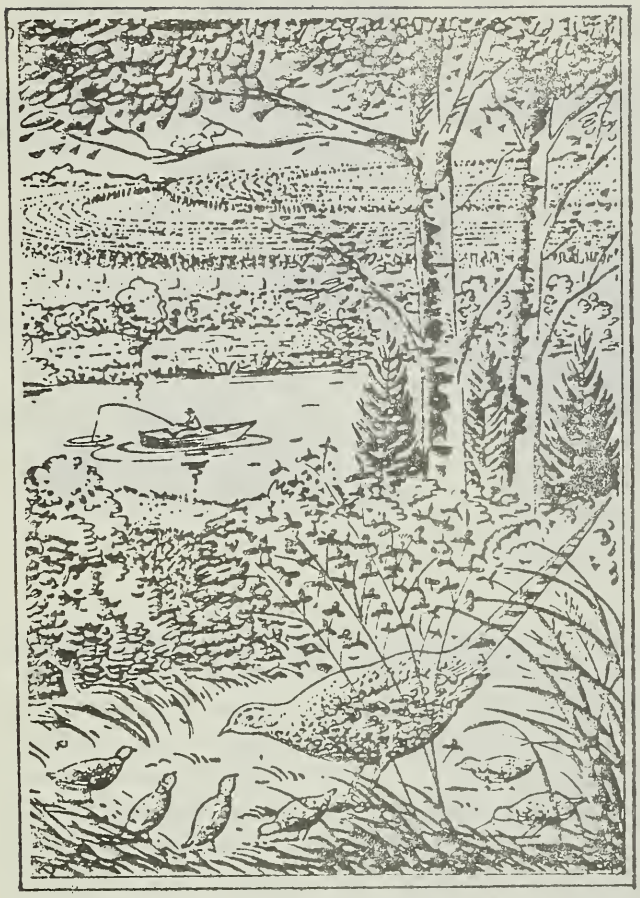
Pasture and Hayland Management - Proper treatment and use of pastureland or hayland. The purpose is to prolong life of desirable forage species; to maintain or improve the quality and quantity of forage; and to protect the soil, and reduce water loss. It is applicable on all pastureland or hayland.



Pasture and Hayland Planting - Establishing and re-establishing long-term stands of adapted species of perennial, biennial, or reseeding forage plants. The purposes are to reduce erosion, to produce high quality forage, and to adjust land use. It is applicable on existing pasture and hayland or on land that is converted from other uses.



Pond - A water impoundment made by constructing a dam or embankment, or by excavating a pit or "dugout." Ponds are constructed to provide water for livestock, fish and wildlife, recreation, fire control, crop and orchard spraying, and other related uses.



Tree Planting - Planting tree seedlings or cuttings. The purposes are to establish or reinforce a stand of trees to conserve soil and moisture; beautify an area; protect a watershed; or produce wood crops. It is applicable in open fields, in understocked woodland, beneath less desirable tree species, or on other areas suitable for producing wood crops; where erosion control or watershed protection is needed; where greater natural beauty is wanted; or where a combination of these is desired.

Wildlife Upland Habitat Management - Retaining, creating, or managing wildlife habitat other than wetland. The purpose is to keep, make, or improve habitat for desired kinds of wildlife. It is applicable on sites (other than wetland) that are suitable for the kinds of wildlife food or cover plants that are needed.

APPENDIX E - DESCRIPTION OF SOIL CAPABILITY CLASSES

Class I—Soils in class I have few limitations that restrict their use.

Soils in this class are suited to a wide range of plants and may be used safely for cultivated crops, pasture, range, woodland, and wildlife. The soils are nearly level and erosion hazard (wind or water) is low. They are deep, generally well drained, and easily worked. They hold water well and are either fairly well supplied with plant nutrients or highly responsive to inputs of fertilizer.

The soils in class I are not subject to damaging overflow. They are productive and suited to intensive cropping. The local climate must be favorable for growing many of the common field crops.

Class II—Soils in class II have some limitations that reduce the choice of plants or require moderate conservation practices.

Soils in class II require careful soil management, including conservation practices, to prevent deterioration or to improve air and water relations when the soils are cultivated. The limitations are few and the practices are easy to apply. The soils may be used for cultivated crops, pasture, range woodland, or wildlife food and cover.

Limitations of soils in class II may include singly or in combination the effects of (1) gentle slopes, (2) moderate susceptibility to wind or water erosion or moderate adverse effects of past erosion, (3) less than ideal soil depth, (4) somewhat unfavorable soil structure and workability, (5) slight to moderate salinity or sodium easily corrected but likely to recur, (6) occasional damaging overflow, (7) wetness correctable by drainage but existing permanently as a moderate limitation, and (8) slight climatic limitations on soil use and management.

Class III—Soils in class III have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Soils in class III have more restrictions than those in class II and when used for cultivated crops the conservation practices are usually more difficult to apply and to maintain. They may be used for cultivated crops, pasture, woodland, range, or wildlife food and cover.

Limitations of soils in class III restrict the amount of clean cultivation; timing of planting, tillage, and harvesting; choice of crops; or some combination of these limitations. The limitations may result from the effects of one or more of the following: (1) Moderately steep slopes; (2) high susceptibility to water or wind erosion or severe adverse effects of past erosion; (3) frequent overflow accompanied by some crop damage; (4) very slow permeability of the subsoil; (5) wetness or some continuing waterlogging after drainage; (6) shallow depths to bedrock, hardpan, fragipan, or claypan that limit the rooting zone and the water storage; (7) low moisture-holding capacity; (8) low fertility not easily corrected; (9) moderate salinity or sodium; or (10) moderate climatic limitations.

Class IV—Soils in class IV have very severe limitations that restrict the choice of plants, require very careful management, or both.

The restrictions in use for soils in class IV are greater than those in class III and the choice of plants is more limited. When these soils are cultivated, more careful management is required and conservation practices are more difficult to apply and maintain. Soils in class IV may be used for crops, pasture, woodland, range, or wildlife food and cover.

Soils in class IV may be well suited to only two or three of the common crops or the harvest produced may be low in relation to inputs over a long period of time. Use for cultivated crops is limited as a result of the effects of one or more permanent features such as (1) steep slopes, (2) severe susceptibility to water or wind erosion, (3) severe effects of past erosion, (4) shallow soils, (5) low moisture-holding capacity, (6) frequent overflows accompanied by severe crop damage, (7) excessive wetness with continuing hazard of waterlogging after drainage, (8) severe salinity or sodium, or (9) moderately adverse climate.

Many sloping soils in class IV in humid areas are suited to occasional but not regular cultivation. Some of the poorly drained, nearly level soils placed in class IV are not subject to erosion but are poorly suited to intertilled crops because of the time required for the soil to dry out in the spring and because of low productivity for cultivated crops. Some soils in class IV are well suited to one or more of the special crops, such as fruits and ornamental trees and shrubs, but this suitability itself is not sufficient to place a soil in class IV.

Class V—Soils in class V have little or no erosion hazard but have other limitations impractical to remove that limit their use largely to pasture, range, woodland, or wildlife food and cover.

Soils in class V have limitations that restrict the kind of plants that can be grown and that prevent normal tillage of cultivated crops. They are nearly level but some are wet, are frequently overflowed by streams, are stony, have climatic limitations, or have some combination of these limitations. Examples of class V are (1) soils of the bottom lands subject to frequent overflow that prevents the normal production of cultivated crops, (2) nearly level soils with a growing season that prevents the normal production of cultivated crops, (3) level or nearly level stony or rocky soils, and (4) ponded areas where drainage for cultivated crops is not feasible but where soils are suitable for grasses or trees. Because of these limitations cultivation of the common crops is not feasible but pastures can be improved and benefits from proper management can be expected.

Class VI—Soils in class VI have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

Physical conditions of soils placed in class VI are such that it is practical to apply range or pasture improvements, if needed, such as seeding, liming, fertilizing, and water control with contour furrows, drainage ditches, diversions, or water spreaders. Soils in class VI have continuing limitations that cannot be corrected, such as (1) steep slope, (2) severe erosion hazard, (3) effects of past erosion, (4) stoniness, (5) shallow rooting zone, (6) excessive wetness or overflow, (7) low moisture capacity, (8) salinity or sodium, or (9) severe climate. Because of one or more of these limitations these soils are not generally suited to cultivated crops. But they may be used for pasture, range, woodland, or wildlife cover or for some combination of these.

Class VII—Soils in class VII have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Physical conditions of soils in class VII are such that it is impractical to apply such pasture or range improvements as seeding, liming, fertilizing, and water control with contour furrows, ditches, diversions, or water spreaders. Soil restrictions are more severe than those in class VI because of one or more continuing limitations that cannot be corrected, such as (1) very steep slopes, (2) erosion, (3) shallow soil, (4) stones, (5) wet soil, (6) salts or sodium, (7) unfavorable climate, or (8) other limitations that make them unsuited to common cultivated crops. They can be used safely for grazing or woodland or wildlife food and cover or for some combination of these under proper management.

Depending upon the soil characteristics and local climate, soils in this class may be well or poorly suited to woodland. They are not suited to any of the common cultivated crops; in unusual instances, some soils in this class may be used for special crops under unusual management practices. Some areas of class VII may need seeding or planting to protect the soil and to prevent damage to adjoining areas.

Class VIII—Soils and landforms in class VIII have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply or to esthetic purposes.

Soils and landforms in class VIII cannot be expected to return significant on-site benefits from management for crops, grasses, or trees, although benefits from wildlife use, watershed protection, or recreation may be possible.

Limitations that cannot be corrected may result from the effects of one or more of the following: (1) Erosion or erosion hazard, (2) severe climate, (3) wet soil, (4) stones, (5) low moisture capacity, and (6) salinity or sodium.

Badlands, rock outcrop, sandy beaches, river wash, mine tailings, and other nearly barren lands are included in class VIII. It may be necessary to give protection and management for plant growth to soils and landforms in class VIII in order to protect other more valuable soils, to control water, or for wildlife or esthetic reasons.

APPENDIX F

Letters of Comment Received on the Draft Environmental Statement (to be included in final Environmental Statement)


SOIL CONSERVATION SERVICE